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ABSTRACT

The purpose for conducting this evaluation was to gather and report information on the degree to which the K-6 Science program for San Diego (California) City School children was meeting the needs for which it was designed. The goals of the evaluation include the following: (1) to describe the K-6 science program as it currently exists in elementary schools and middle schools with sixth grades; (2) to examine program goals, content, instruction, and effectiveness against criteria and standards established by the California State Science Framework Addendum (1984) and the new California State Science Framework (1990); (3) to examine the program from the perspectives of San Diego City Schools curriculum experts, principals, teachers, students, and parents; (4) to derive interpretations of the study's findings and draw conclusions regarding program strengths, needs, and priorities; and (5) to offer recommendations for program improvement as requested by the Education Services Division. The evaluation questions, study components, limitations of the evaluation, findings of the study, and conclusions and recommendations are included. The findings section answers the following questions: What comprises the district K-6 program? What instructional strategies are used by teachers in the district science program? How do teachers, administrators, students, and parents feel about the science program? How is science incorporated into the daily program? How do district elementary teachers utilize community resources? What is the degree of student learning in science? How do schools compare within the district? Appendix A includes the methodology, survey instrument, and responses of the classroom teacher survey. Appendix B includes the methodology, survey instruments, and responses of the student and parent surveys. Appendix C includes the methodology and instruments of the principal interviews, classroom observations, and teacher schedule review. Appendix D includes the fact sheets, methodology, and results from the Elementary Science Program Evaluation Test (ESPET). (KR)

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San Diego City Schools
PLANNING, RESEARCH, AND EVALUATION DIVISION

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EVALUATION OF THE K-6 SCIENCE PROGRAM

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NOVEMBER 13, 1990

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EVALUATION DEPARTMENT REPORT

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EVALUATION OF THE K-6 SCIENCE PROGRAM

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- the 644 parents of second, fourth, and sixth grade children who responded to the parent survey.
- the 1047 second, fourth, and sixth grade children who responded to the surveys developed for them.
- the 39 district staff members who attended ESPET training, administered the test at sites, and participated in central scoring.
- the 90 fourth-grade teachers at 23 schools who permitted their 1738 students to participate in the New York State Elementary Science Program Evaluation Test (ESPET).

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SAN DIEGO CITY SCHOOLS
Planning, Research, and Evaluation Division
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EVALUATION OF THE K-6 SCIENCE PROGRAM

SUMMARY

ISSUE/CONCERN

The Plan for Systematic Evaluation of Regular District Programs calls for the comprehensive evaluation of major instructional programs on a six-year cycle. The board of education and superintendent selected K-6 Science for the 1989-90 school year for several reasons:

- The science program annually involves every K-6 student in the district.
- National studies are recognizing the importance of quality science instruction and are calling for major reforms in the teaching of science.
- In the last few years, the district changed the format of elementary science instruction from a rotational schedule to a subject allocated 150 minutes per week, with textbooks and materials provided for each classroom.
- The State of California has developed a new science curriculum framework, and district curriculum specialists are preparing for its implementation.

RECOMMENDATIONS TO STAFF

1. The Math and Science Office of the Basic Education Department should continue to provide proactive leadership to school sites in order to develop specific goals aligned with the 1990 California Science Framework. Such leadership will assist schools to focus on goals appropriate to their school levels and obtain necessary inservice opportunities.
2. The recommended amount of hands-on science instruction for elementary classrooms should be specified by the district in the Course of Study, K-12. These suggested standards should meet the 1990 California Science Framework guidelines.
3. To further align the district K-6 science program with the 1990 California Science Framework, the district's Math and Science Office should continue to encourage the integration of science with other subject areas through inservice training.

4. School staffs should examine the priority that science currently holds at their sites. They should realign science instruction to give it more depth than breadth and to use staff talent and resources more efficiently.

5. Site leadership should be responsive to school needs, taking responsibility for scheduling appropriate science inservice training for classroom teachers.

6. Site leadership should assess parental attitudes about the importance of elementary science instruction and provide a variety of opportunities for parents to participate in the science program. In addition, site leadership should communicate their belief in the importance of science to parents and students. Pupil progress reports should include a science grade for each reporting period in which science is taught. Increased involvement in science-related cocurricular activities would be a tangible way to value science and should be made available and encouraged by site leadership.

7. School site leadership should encourage teachers to use strategies for science instruction which make efficient use of their time and subject matter expertise. In addition, teachers should be advised of the science program sequence they are scheduled to follow each year. The unmet needs reported by teachers (time, materials, and inservices) should be given high priority by site administrators and staffs.

8. Each school, with the assistance of the district's Math and Science Office, should ensure that all students have access to a high quality science program including appropriate facilities and adequate instructional time. In particular, the allotment of time for sixth-grade science in middle schools needs to be revised to meet district guidelines.

9. The district's Math and Science Office should continue its proactive approach to teacher inservice training, emphasizing hands-on science activities and alternative assessment techniques. The Evaluation Department should provide technical assistance in the area of alternative assessment. Student assessment will include observation of student lab activities, performance-based testing, and portfolios of student work across units of study.

RATIONALE

More than 300 studies in recent years have chronicled the abysmal state of science education in the United States. Student scores from the National Assessment of Educational Progress (NAEP) plummeted in the 1970's and had only begun to recover in the 1986 assessment. A recent study conducted by the Educational Testing Service claimed 45 percent of the nation's third graders do some experimental activity only once a year or never. They further report that more than half of all third graders nationally have never taken a science field trip.

Attention to the dismal state of science instruction has spurred a variety of reform efforts at the state and national levels. The latter half of the 1980's was a frantic period of national reform, generating several documents to guide educators toward better science instruction. One of these was Getting Started in Science: A Blueprint for Elementary School Science Education (1989), published by the National Center for Improving Science Education. The report advocates a hands-on inquiry-based science program in elementary school to best provide science preparation for all students and recommends that science curriculum be organized within a framework of concepts, attitudes, and skills.

The new California Science Framework (1990) mirrors this same view of science. The framework endorses a thematic treatment of science content, emphasizing the connections between facts and theoretical constructs. It addresses six themes: evolution, energy, patterns of change, stability, scale and structure, and systems and interactions. Along with other science reformers, it advocates depth over breadth. The framework suggests that material should be presented in such a fashion that children will acquire deep conceptual understandings, instead of vocabulary lists and isolated facts. The framework is based on constructivism, a system in which students create their own models to help understand the natural world. At the elementary level, the framework calls for an emphasis on science instruction including multiple opportunities for students to spend time in hands-on activities. Assessment should also follow this emphasis, with performance tasks substituting for paper-and-pencil factual recall tests.

BUDGET IMPLICATIONS

No specific budget adjustments are recommended.

SAN DIEGO CITY SCHOOLS
Planning, Research, and Evaluation Division
Evaluation Department

EVALUATION OF THE K-6 SCIENCE PROGRAM

ISSUE/CONCERN

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- The science program annually involves every K-6 student in the district.
- National studies are recognizing the importance of quality science instruction and are calling for major reforms in the teaching of science.
- In the last few years, the district changed the format of elementary science instruction from a rotational schedule to a subject allocated 150 minutes per week, with textbooks and materials provided for each classroom.
- The State of California has developed a new science curriculum framework, and district curriculum specialists are preparing for its implementation.

BACKGROUND

> Science is constructed of facts, as a house is of stones. But a collection of facts is no more a science than a heap of stones is a house.
>
> Henri Poincare (1860-1934)
> *Science and Hypothesis*

President Bush, in his recent Education Summit with the nation's governors, set a goal for science education that challenges all educators to the extreme: to be first in the world in math and science achievement by the year 2000. This call for reform arises from the ignominy of our present position in science achievement--at the bottom. According to the cover story in Newsweek "Not Just for Nerds: How to Teach Science to Our Kids" (April 9, 1990), when compared to students from around the world, American high school students ranked eleventh (out of 13) in chemistry, ninth in physics, and last in biology. The 1988 report, Science Achievement in Seventeen Countries, ranked United States ten-year-olds fourth in the 1970's, and eighth in the 1980's.

More than 300 studies in recent years have chronicled the abysmal state of science education in the United States. In addition to international comparisons, students' scores from the National Assessment of Educational Progress (NAEP) plummeted in the 1970's and only began to recover in the 1986 assessment. A recent study conducted by the Educational Testing Service showed 45 percent of the nation's third graders do some experimental activity only once a year or never. They further report that more than half of all third graders nationally have never taken a science field trip.

> In too many classrooms across the United States, science is still taught as a cohesive set of facts to be absorbed, and children are viewed as blank slates on which teachers are to write.
>
> Richard Konicek
> Professor of Science Education
> University of Massachusetts

How did science education come to such a lamentable position? As far back as the 1920's, John Dewey called for science to be a subject of inquiry. The Sputnik panic of the late 1950's was supposed to revolutionize science instruction in America. In fact, in the post-Sputnik era, millions of dollars were made available for writing and improving science curricula. The 1960's were full of innovative, child-centered, inquiry-based science programs, such as Science Curriculum Improvement Study (SCIS) and Elementary Science Study (ESS). Additional programs were developed in the 1970's and 80's, including Conceptually Oriented Program in Elementary Science (COPES), Great Explorations in Math and Science (GEMS) and Activities to Integrate Math and Science (AIMS).

Unfortunately, the basic science textbooks used in most schools did not reflect much of this change. Consequently, most science reform never reached the classroom. Paul DeHart Hurd, professor emeritus at Stanford University, estimates that no more than five percent of American teachers are teaching inquiry-based science in classrooms today.

Attention to the dismal state of science instruction has spurred a variety of reform efforts at the state and national levels. The latter half of the 1980's was a frantic period of national reform, generating several documents to guide educators toward better science instruction. One of the most highly regarded is Getting Started in Science: A Blueprint for Elementary School Science Education (1989), published by the National Center for Improving Science Education. The report advocates a hands-on, inquiry-based science program in elementary school to best provide science preparation for all students. According to the report:

> Hands-on science stimulates children's natural curiosity about science and thus encourages them to persist in the study of science. Hands-on science stimulates children to ask questions and to be skeptical of ready-

made answers -- good attributes for citizens in a democracy. Hands-on science teaches students to solve problems and to work cooperatively with others in seeking solutions.

The report recommends that the curriculum be organized within a framework of concepts, attitudes, and skills.

Several other major reform efforts are highlighted below.

- Project 2061, named for the year in which Halley's comet will next appear, has as its goals the reform of science curricula in the nation's schools, making Americans "science literate" and helping them see the connection between science and everyday life. Six districts from around the country (including San Diego) were selected to be project sites, sharing information and working on curriculum models in science education. The local group includes five elementary teachers, five middle school teachers, ten high school teachers, three principals, and two curriculum specialists. A major premise of Project 2061 is that schools do not need to teach more content, but rather should focus on teaching what is essential to scientific literacy and to teach it more effectively. Connections between subject matter areas are emphasized, and boundaries between subjects are softened. Ideas and thinking skills are emphasized over vocabulary and memorization of detail. The project is expected to create a national K-12 science curriculum allowing choices for individual districts.

- SCIENCEGRASP! IT'S ELEMENTARY is a program sponsored by the National Science Teachers Association and the Upjohn Company and designed to improve science teaching at the elementary school level. It consists of activities to enhance the science background of elementary teachers and increase their awareness of hands-on science teaching activities.

- The Industry Council on Science Education was formed in June 1990 to help mobilize science education reform in order to "regain the edge" in science. Council members are representatives of major corporations. The council will work to enhance the public image of science education by changing negative perceptions about science.

- The California Science Implementation Network (CSIN), a cooperative effort of the State Department of Education, the University of California at Irvine, and Far West Lab, assists elementary schools in California to develop an articulated schoolwide science program stressing inquiry skills and hands-on, process-centered science units. Science staff developers are located regionally and are given professional development in the techniques of peer coaching, adult learning, and site-based implementation models.

- The National Science Foundation is offering grants to states that want to revamp their science and math education programs. It underwrites projects that promote interdisciplinary, inquiry-based approaches to contemporary issues in science.

- The National Research Council and the Smithsonian Institution have joined forces to establish a National Science Resources Center to train teachers and help bring active science instruction into the schools.

- Hughes Aircraft is developing a 15 segment series on science for children in grades K-2. Thirty-five to forty schools will be selected to participate on a pilot basis. Intensive staff development will occur in the summer of 1991 to introduce teachers to the techniques of hands-on, inquiry-based science. The Planning, Research, and Evaluation Division of San Diego City Schools has been assisting Hughes as a resource for the project.

- Science Weekly, a bi-weekly science news magazine available for children at several grade levels, encourages inquiry and experimentation in a lively format. It also includes parent activities, storytelling, and enrichment questions. The magazine is available for $2.80 per student per semester.

The prime motivator for change in science instruction in California schools is found in the new California Science Framework (1990), which reflects a major departure from the previous framework (issued in 1978) and its addendum, issued in 1984. The framework endorses a thematic treatment of science content that emphasizes the connections between facts and theoretical constructs. It addresses six themes: evolution, energy, patterns of change, stability, scale and structure, and systems and interactions. Along with other science reformers, it advocates depth over breadth.

The framework suggests that material should be presented in such a fashion that children will acquire deep conceptual understandings, instead of vocabulary lists and isolated facts. The framework is based on constructivism, a system in which students create their own models to help understand the natural world. At the elementary level, the framework calls for an emphasis on daily science instruction, with multiple opportunities for students to spend time in hands-on activities. Assessment also follows this emphasis, with performance tasks substituting for paper-and-pencil factual recall tests.

> Science education has moved away from learning the major ideas in the field to a point where students study the trees, but fail to understand what the forest is.
>
> Bill Honig
> California Superintendent of Public Instruction

In the 1988 Search for Excellence in Science Education, San Diego City Schools was selected as a state finalist for its K-6 science program. Other districts have dramatically reorganized their science programs to revitalize the teaching of science for young children. The following districts have done away with commercial texts entirely in order to focus on fewer topics in greater depth. Examples follow:

- Pasadena (CA) Unified School District uses no textbooks in the elementary grades. Rather, they use kits from commercial and nonprofit publishers, building in-depth units about areas of interest to children. For example, second graders might study plant growth and development in a series of several units. Fourth and fifth graders spend time with batteries, bulbs and wires to learn about electrical circuits.

- Anchorage (AK) School District uses a district-developed hands-on science curriculum in its 54 elementary schools. Curriculum and materials have been organized in kits, with four basic kits for each grade level. Each kit contains a teacher resource manual, all the instructional materials needed for that unit, and evaluation forms which are available on a rotational basis from the district Elementary Science Center. Staff development is accomplished by inservice training and the use of videotapes for each unit. The videotapes build interest for the content from the kit, provide demonstrations of the performance activities, and suggest extension or integration activities for the unit.

- Rochester (NY) city school system has developed an integrated science curriculum which depends on the constant supply of experimental material from a resource center to every science class in the system, grades K-12. The center approach is estimated to save between 20-50 percent of the cost of commercial texts and materials.

- In Fairfax County (VA), the homegrown hands-on elementary school science program provides science education for all 60,000 elementary students, mandatory inservice training for all elementary teachers, and instructional resources (materials, guides, and science reading materials) for each classroom.

PURPOSE OF THE STUDY

The purpose for conducting this evaluation was to gather and report information on the degree to which the K-6 Science program for San Diego City Schools children was meeting the needs for which it was designed. The board of education and superintendent are the primary audience for this report. The second critical audience consists of Educational Services Division personnel, school administrators, and K-6 teachers who include science instruction as part of their regular program. Science educators from around the country have also expressed a strong interest in the results of this study.

An evaluation plan was developed which specified the evaluation questions to be addressed. Curriculum experts from the district's Math and Science Office and members of the K-6 Science Evaluation Advisory Committee (see Design section) assisted the Evaluation Department team to develop and refine the evaluation plan. The goals for the evaluation include the following:

- To describe the K-6 science program as it currently exists in elementary schools and middle schools with sixth grades.

- To examine program goals, content, instruction, and effectiveness against criteria and standards established by the California State Science Framework Addendum (1984) and the new California State Science Framework (1990).

- To examine the program from the perspectives of San Diego City Schools curriculum experts, principals, teachers, students, and parents.

- To derive interpretations of the study's findings and draw conclusions regarding program strengths, needs, and priorities.
- To offer recommendations for program improvement as requested by the Educational Services Division.

Evaluation Questions

The study was designed to answer the following questions about K-6 science instruction:

1. What comprises the district K-6 science program?
2. What instructional strategies are used by teachers in the district program?
3. How do parents, teachers, and administrators feel about the science program?
4. How is science incorporated into the daily program?
5. How do district elementary teachers utilize community resources?
6. What is the degree of student learning in science?
7. How do schools compare within the district?

DESIGN OF THE STUDY

An advisory committee collaborated to guide this program evaluation project from design to implementation to analysis of the study's findings. Members of the committee represented the Planning, Research, and Evaluation (PRE) Division, Educational Services Division, site administrators, and teachers. The committee also included faculty members from local public universities. (A list of all advisory committee members is included in the Acknowledgements section.)

Data for this study were obtained through a variety of sources: document analysis and literature reviews, a review of classroom schedules, classroom observations in grades K-6, interviews with elementary and middle school principals, surveys administered to K-6 teachers, students in grades 2, 4, and 6 (and their parents), and the use of a performance-based science test with district fourth-grade students. Each component of the study will be described briefly in this section. Readers may consult the Appendices of this report (bound separately) for a more detailed description of the research methodologies that were followed in gathering information for each part of this study.

Study Components

Document analysis included a review of classroom schedules for all K-6 teachers in 26 elementary schools and two middle schools with sixth grades. Classroom schedules outline the subject areas taught by each teacher during a week's time and include the time (in minutes) allotted to each subject. A total of 539 weekly schedules were studied. The study also examined Program Quality/Integration Review (PQIR) reports from 1988-89 and 1989-90 for these same schools. PQIR studies are a combination of the state Program Quality Review assessments and the district's Integration Monitoring process. One of the subjects reviewed at each school is science. Staff Bulletins were examined for the period 1988-90 to look for evidence of recognitions and activities highlighted in K-6 Science.

Classroom observations in grades K-6 were conducted by the project consultant, Ms. Merrilee Finley. A total of 77 observations occurred in 12 elementary schools and one middle school with a sixth grade. These were schools which had been through the PQIR process in either 1988-89 or 1989-90. These particular schools were selected so that observation data from PQIR could be compared to the data from the present study. Observations were done in English and Spanish. The instrument developed for the observations was reviewed by both the project advisory committee and the consultant before its use. Teachers from each grade level at the schools were randomly selected for observation, but did receive notification of the upcoming visit by the consultant.

Interviews with elementary and middle school principals were also conducted by the project consultant. Interviews took place at the same schools in which classroom observations were conducted in order to provide complementary data about the science programs at those sites. The interview questionnaire was reviewed by the project advisory committee, PRE division personnel, and the consultant before its use.

Interviews were also conducted with district science program specialists, AGP personnel, and the science materials coordinator from the Instructional Media Center.

K-6 teacher surveys were administered to a random one-third sample of all elementary school teachers and to all middle school teachers who were responsible for science instruction for sixth grade students. A total of 494 teachers, or 56 percent, responded.

Student surveys were administered to students in grades 2, 4, and 6 at 57 elementary schools and four middle schools with sixth grades. One classroom per school was randomly selected. Schools selected for this part of the study had not participated in the performance-based science test or the classroom observations. Researchers felt that the first two groups of schools had been significantly impacted by those study components and should not be asked to participate in another evaluation activity. Student surveys were administered by the classroom teachers in either English or Spanish. A total of 1048 surveys were returned, or 62 percent of the 1700 student forms distributed to schools.

Parent surveys, available in English and Spanish, were sent home with each of the students who had participated in the student survey component. Of the 1700 surveys distributed to schools for parents, 644 were returned, or 38 percent. All surveys were reviewed by the project advisory committee and PRE Division personnel before their distribution.

New York State Elementary Science Program Evaluation Test (ESPET) is a performance-based science test developed by the Science Bureau of the New York State Education Department for use with fourth-grade students. It is not an achievement test, but rather an evaluation tool to examine the strengths and weaknesses of science programs. The objective of ESPET is to improve science education by testing the manipulative and thinking skills expected to be in evidence by fourth grade. A correlation was made between the skills tested in ESPET and the skills taught in the district program in grades K-4. It was determined that it would be appropriate to expect ESPET skills from district fourth graders. Twenty-three district elementary schools participated in

ESPET testing, reaching a total of 1738 students, or about a 20 percent sample of all district fourth graders.

Limitations of the Evaluation

Any curriculum study is limited by the lack of sufficient resources to examine every aspect of the program. While this evaluation was comprehensive in nature, gathering the perspectives of science curriculum specialists, administrators, teachers, students, and parents, it could not include the direct examination and appraisal of specific science units of instruction. Additionally, it did not address the controversies surrounding evolution and creationism, nor the quandary about the role of health instruction as a component of science or physical education. Finally, the evaluation did not include discussion of junior/senior high school practices or issues.

FINDINGS OF THE STUDY

The evaluation questions that guided the design of the study will serve as the vehicle for reporting its major findings.

1. What comprises the district K-6 science program?

Program Goals

> Educators get in trouble when they forget that the best way for students to learn science is to do science. . . . Youngsters should observe, measure, collect, categorize, record and interpret data. . . .The best science lessons teach less, emphasizing depth rather than breadth.
>
> "Rx for Learning"
> *Newsweek* (April 9, 1990)

According to the San Diego City School's Course of Study, K-12 science is defined as

> "the study of facts, principles and theories that describe the world around us and a set of processes by which people systematically acquire and refine this knowledge."

Correlation of District Program Goals with the Current Framework

The district aligns its science course of study, as much as possible, with the science framework developed under the leadership of the State Department of Education. The current state framework, published in 1978 and amended in 1984, provides extensive descriptions of program goals and objectives. A comparison of major goals for the 1978 framework and the district science program show that the district program was clearly developed on the solid ground of the current framework.

TABLE 1
Comparison of District and Current Framework Goals

California Framework Goals (1978)	District Program Goals
To develop knowledge of processes, facts, principles, generalizations, and applications--the products of science--and encourage their use in the interpretation of the natural environment.	To understand the processes, facts, principles, generalizations and applications of science and to encourage their use in interpreting the natural world.
To develop fundamental skills in the manipulation of materials and equipment; in the care and handling of living organisms; and in the collection, organization, and communication of scientific information.	To demonstrate skill in handling materials and equipment, in caring for living organisms, and in gathering, organizing and communicating scientific information.
To develop and apply rational and creative thinking processes.	To promote rational and creative thinking processes.
To develop values, aspirations, and attitudes that promote the individual's personal involvement with the environment and society.	To develop attitudes and values that inspire personal involvement in societal and environmental concerns.

Sources: California Science Framework (1978)
San Diego City Schools Course of Study, K-12

The selection of a science series in 1985-86 and the commitment to purchase materials sufficient for each classroom were major steps in science education for the district. Prior to the Silver Burdett adoption, science materials were rotated among elementary schools on a nine-week basis. Science was generally perceived by teachers as a step-sister to the "real" content areas of language arts and math, which provided full complements of materials to the classrooms.

Correlation of District Program Goals with the 1990 Framework

While it is not fair to judge the current K-6 science program in the light of the new framework, it will be helpful to curriculum specialists and elementary teachers in determining how the district program and the 1990 framework are already in congruence, and how the framework suggests future direction.

The 1990 framework, as noted earlier, changes the way science content is viewed and presented. The organization of science material into themes is a radical departure from the behavioral objective organization of the old framework. Instead of promoting breadth, the new framework emphasizes depth. Coverage takes a back seat to understanding. The district's goals can still be found in the new framework in its emphasis on the joy of science, development of scientific processes and thinking, and its promotion of positive attitudes about science and its role in society.

Foreshadowing the new framework, the district's Course of Study, K-12 recommends that a laboratory or hands-on approach be used in science. It further suggests that process skills should be the primary emphasis rather than the memorization of fact. Students should practice critical questioning and develop an understanding of the interdependence between science and society.

District Science Materials Provided and Costs

The Silver Burdett series, Science, was adopted by the district for use in the 1986-87 school year. Each teacher receives a set of classroom textbooks, a teacher's manual, and a science kit. The kits contain materials needed for science activities at a given grade level plus a terrarium, balances, meter sticks, and metric weights. The cost per kit is about $300 and the district's annual refurbishment costs are estimated to be between $40,000-$50,000. The Silver Burdett series also comes with worksheets, tests, and filmstrips to accompany each unit.

In addition to publisher's materials, teachers are encouraged to use the district-developed Teacher's Guides, which correlate the commercial program with related concepts from other district subject areas (language arts, social studies, health, and ELEPS). The district guides explain the division of science lessons into Sequences A and B. Teachers alternate between Sequence A and B on a yearly basis, using approximately half the textbook's chapters each year. The guides provide additional activities, worksheets, bibliographies of children's literature, and audio-visual materials available at the Instructional Media Center to accompany the Silver Burdett lessons. The guides are given to every K-6 teacher of science with the intention that they be used to provide students with an integrated and comprehensive instructional program.

Use and Acceptance of District Science Materials

According to the principals interviewed, teachers regularly use the district curricular materials for science instruction. All reported that 100 percent of the teachers at their schools use the district texts and teachers' guides. Most use the series filmstrips as well. Half the principals reported that teachers use the science kits regularly; the other half reported less than unanimous use. Principals based their opinions on the volume of requests for kit refurbishment at their sites.

Principals made a distinction between teacher comfort with the text materials and comfort with the science kit. A certain amount of discomfort, they noted, came from the time it takes to prepare for, set up, use, and clean up after kit activities. Since science is taught in the afternoons at most schools, time for science is limited.

In the survey, teachers rated the full range of science materials as to their quality. Table 2 lists the materials in order of highest-rated to lowest. Science kits were rated by 54 percent of the teachers as above average, while only 33 percent of the teachers felt that student texts were above average.

TABLE 2
Science Materials Rated "Above Average" by Teachers

Type of Material	Percent of Teachers Rating "Above Average"
Silver Burdett Science Kits	54%
Silver Burdett Filmstrips	40%
Silver Burdett Teacher's Manual	38%
Silver Burdett Student Texts	33%
District Curriculum Guides	26%
Silver Burdett Student Worksheets	25%
Silver Burdett Tests	22%

Source: K-6 Science Evaluation Teachers Survey, 1990

Teachers were also asked to describe their use of certain materials to augment their science lessons. Textbooks were not included as an item in this question. The science kits were reported most frequently used (43 percent), followed by audio-visual materials (39 percent). Those materials include, but are not limited to, the Silver Burdett filmstrip sets. When asked what kinds of materials they typically use in science lessons, most teachers (64 percent) reported that they use a combination of district, commercial, and teacher-made materials. This practice was most evident among kindergarten and primary grade teachers, with 75 percent and 73 percent reporting respectively. Of the upper-grade teachers, 56 percent reported using a combination of the three types of materials.

Principal interviews corroborated the widespread practice of supplementing the district curriculum with other materials. According to the principals, teachers often use filmstrips and videotapes from the Instructional Media Center and materials from community resources, and also like to capitalize on current events and areas of interest to the children.

Data from the classroom observations supported the teachers' reported use of materials. For example, the most commonly observed material in use in addition to the text was the science kit. However, it was not observed in use to the the extent reported by teachers. Over all grade levels, it was observed in use in 23 percent of the classroom lessons, whereas 43 percent of the teachers reported using kit materials frequently. Teacher-made materials were observed to be in use more frequently than science kits.

TABLE 3
Frequency of Materials in Use During Observed Science Lessons

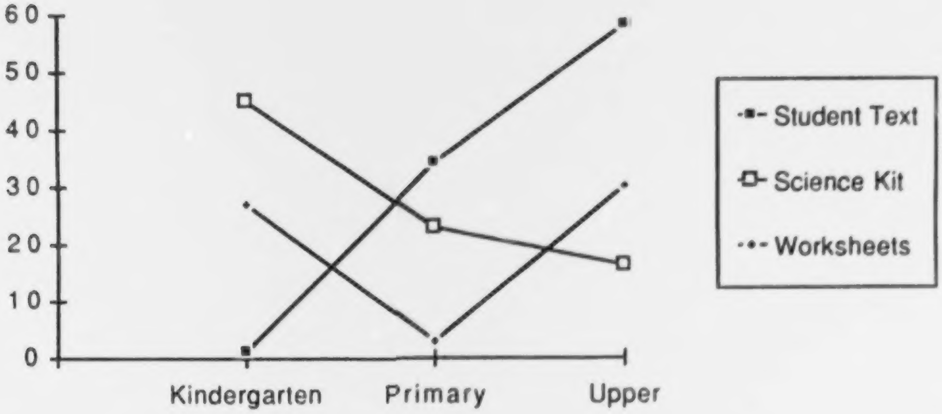
	Percent of Lessons in Which Material Used			
Instructional Materials	All	K	Primary	Upper
District Materials				
Textbooks	40%	1%	34%	58%
Teachers' Editions	35%	27%	37%	35%
Science Kit	23%	45%	23%	16%
Worksheet	17%	27%	3%	30%
Other Materials				
Teacher Made	30%	36%	26%	33%
Commerical	14%	9%	20%	10%
Number of Classrooms	77	11	35	31

Source: K-6 Science Evaluation Classroom Observations, 1990

As Table 3 indicates, the district textbook series was observed in use in 40 percent of all classroom lessons. Texts were most frequently observed in use in the upper grades, and the teachers' edition accompanying the textbook series was also in frequent use. Teacher-made materials were also prevalent during science lessons. These often included craft or art assignments and experimental activities for which teachers had devised and assembled the materials. Teachers had designed worksheets, diagrams and charts, and lab report formats to accompany reading and/or hands-on activities in many of these lessons.

Figure 1 uses the information from Table 3 to show more visually the differences by grade groupings in frequency of use of textbooks, science kits, and worksheets. As the grade level increases, use of student text increases dramatically, use of kits decreases, and use of worksheets dips and then rises again.

TEACHER USE OF SCIENCE MATERIALS
BY KINDERGARTEN, PRIMARY, AND UPPER GRADE LEVELS



Source: K-6 Science Evaluation Classroom Observations, 1990

Figure 1. Teacher Use of Science Materials by Kindergarten, Primary, and Upper Grade Levels

Culturally Specific Materials

The 1990 Science Framework clearly calls for learning materials that can "readily demonstrate the expanding presence of females, minorities, and persons with disabilities in science careers and avocations." By intent, Silver Burdett materials are cross-cultural. They reflect the racial/ethnic backgrounds and contributions of district students in their portrayal of children and emphasis on addressing current scientific discoveries. The district-produced Teacher's Guides suggest multicultural extension activities which include literature, songs, and games from other countries and from non-White perspectives. However, **no culturally specific materials** (developed to address the perspectives and contributions of one racial/ethnic group in science) were either reported by teachers or administrators to be in use, nor were they observed in use by the project consultant in district classrooms. In the course of this study, the researchers only learned of one commercial publisher of culturally specific materials in science, the BACKPAX Company.

Some individual classes and schools extend multicultural learning by recognizing the contributions of individuals from diverse backgrounds and by inviting speakers who represent those cultural backgrounds to talk about science. For example, one school highlights an individual every month, some having scientific backgrounds, and the children learn how that person enriched (or continues to enrich) the world in which we live. One school used career speakers provided by the school's partner, an organization of African American engineers and scientists. Another school offered presentations by the school's pupil advocate to parent groups and classrooms on African American contributions in science.

In summary:

- The goals of the district science program are closely aligned with the 1978 California Science Framework. They also parallel the emphases of the 1990 framework and articulate the teaching practices suggested in the new framework.
- Materials for science instruction, including texts, kits, and filmstrips, are distributed to all K-6 teachers in the district.
- Teachers rated the science kits most highly in terms of quality, although principals reported some teachers are hesitant to use them. Teachers, however, use the kits most frequently as supplemental science materials to the textbooks. Classroom observations confirmed the use of the kits as the most frequent supplemental material, but kits were not observed in use to the extent indicated by teacher reports.
- Most teachers use a combination of district, commercial, and teacher-made materials in their science lessons.
- District science materials are inclusive of multicultural contributions, and some schools and classes supplement these materials with additional information and speakers. No culturally specific materials in science were reported or observed in use in district classrooms.
- Some differences are evident in science instruction between K-3 teachers and teachers of grades 4-6. K-3 teachers are more likely to use a variety of materials because they are less dependent on textbook instruction. They also use kits more frequently than upper grade teachers.

2. What instructional strategies are used by teachers in the district science program?

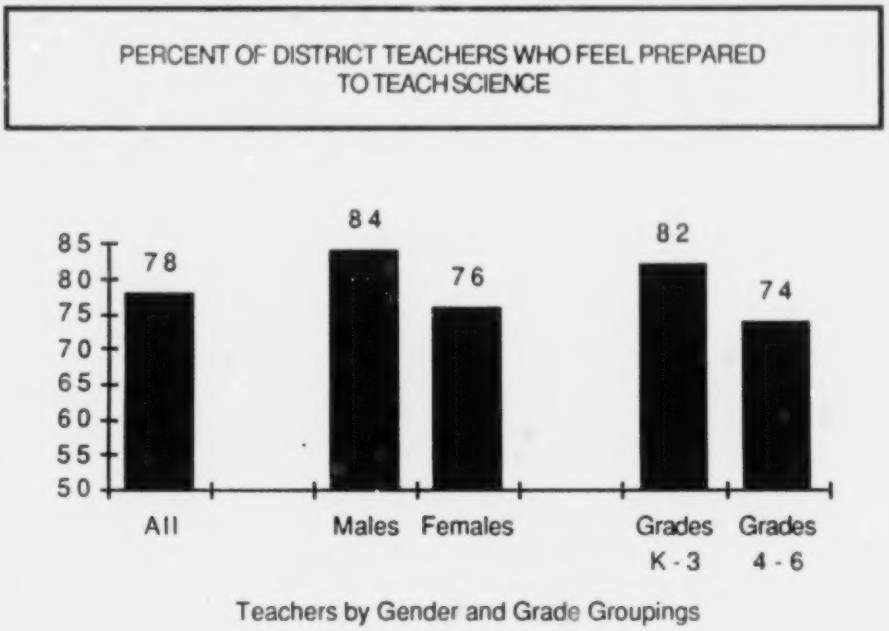
Preparation to Teach Science

> Most people teaching elementary school today didn't study physical science in college at all, and they last dealt with basic chemistry and physics when they were in high school, possibly as long as 30 years ago.
>
> Yvonne Baron Estes
> "Breakout--Catch a Wave in Science"
> *Phi Delta Kappan* (May 1990)

According to the National Center for Improving Science Education in Arlington, VA, only 31 percent of the nation's K-3 teachers and 42 percent of 4-6 teachers have taken beginning courses in biology, physics, and earth science. Fewer than half the states require elementary teachers to take a course in the methods of teaching science. To teach in any self-contained classroom in California below Grade 9, a teacher must be authorized for multiple subject instruction and have a minimum of eight semester hours in the subjects to be taught.

In this local study, 24 percent of teachers responding to the survey said they had taken three science courses in college, and 38 percent reported having taken more than three courses. In addition, 63 percent took a course in the methods of teaching science. It appears, then, that San Diego City Schools K-6 teachers have had more extensive exposure to college-level science than their national counterparts.

The same national study cited above found that only 27 percent of elementary school teachers in the United States feel well-qualified to teach science, as contrasted to 82 percent and 67 percent who feel well-qualified to teach reading and mathematics, respectively. A much higher percentage of San Diego teachers have a fairly high level of confidence about science, as is shown in Figure 2.



Source: K-6 Science Evaluation Teacher Survey, 1990

Figure 2. Percent of District Teachers Who Feel Prepared to Teach Science

Even though teachers seem to feel prepared to teach science, and most have taken three or more college courses in science, only 38 percent of the teachers responding to the survey felt that their teacher preparation classes prepared them to actually teach science. This disparity indicates that pre-service teachers might benefit from college training more closely correlated to teaching techniques in the elementary classroom.

Teachers responded that they keep current in science primarily through their professional reading (66 percent). One-third have attended a variety of conferences, and 28 percent have attended mentor teacher demonstrations. Nearly 20 percent reported that their involvement with professional organizations have helped them to stay current in science.

Instructional Strategies

> Consider the typical situation in the United States. Children study science in elementary school mainly by reading about it.
>
> Bill Aldridge
> National Science Teachers Association

According to the 1986 National Assessment of Educational Progress (NAEP) in elementary science, 60 percent of the nation's third graders responded that their science instruction consists of reading science textbooks. Kathy DiRanna, director of the California Science Implementation Network, postulates that three "kinds" of science are typically taught in elementary schools:

1. None at all
2. Students' favorite topics (e.g.,dinosaurs, space exploration)
3. Comprehensive and integrated science programs

Ms. DiRanna estimates that less than ten percent of all California classroom teachers implement comprehensive programs. She compares the goals of the 1990 California Science Framework with the reality of present science instruction in the state.

TABLE 4
Comparison of 1990 Science Framework and
Realities of Science Instruction Today

Goals of 1990 Framework	Reality of Classroom Instruction
Enjoyment, Fascination	Anxiety, Avoidance
Themes and Concepts	Isolated Facts
Variety of Units	Students' Favorites
Hands-on, Investigations	Texts, Dittos, Vocabulary
Inquiry, Questioning	Rote, Paper and Pencil Activities
Persistence and Flexibility	Dependence on One Right Answer
Interaction among Students and Small Group Work	Students Isolated with Textbooks

Source: California Science Implementation Network, 1990

> Schools take naturally curious, natural scientists and manage to beat that curiosity right out of them. . . Most schools still teach science by lecture, textbook, and memorization. Those three unnatural elements combine to produce a familiar chemical reaction: boredom.
>
> "Rx for Learning"
> *Newsweek* (April 9, 1990)

Data were collected from two sources about the use of instructional strategies in science. (1) In the survey, teachers were asked about the strategies they typically use in science instruction. (2) In classroom observations, instructional strategies were noted for each science lesson observed. Table 5 presents the similarities and differences in what teachers **reported doing and what they were observed doing**.

TABLE 5
Instructional Strategies Used Most Frequently in Science
as Reported by Teachers and Observed in Classroom Lessons

Most Frequently Used Strategies As Reported by Teachers	Most Frequently Used Strategies As Reported by Classroom Observation
1. Class Discussion (87%)	1. Experiments/Activities (65%) (Student Participation)
2. Textbook Instruction (72%)	2. Class Discussion (64%)
3. Cooperative Learning (47%)	3. Teacher Summary and (61%) Student Recitation *
4. Experiments/Activities (44%) (Student Participation)	4. Experiments/Activities (44%) (Teacher Demonstration)
5. Experiments/Activities (36%) (Teacher Demonstration)	5. Textbook Instruction (42%)
6. Integrated Curriculum (29%)	6. Integrated Curriculum (36%)
7. Science Projects (23%)	7. Cooperative Learning (31%)

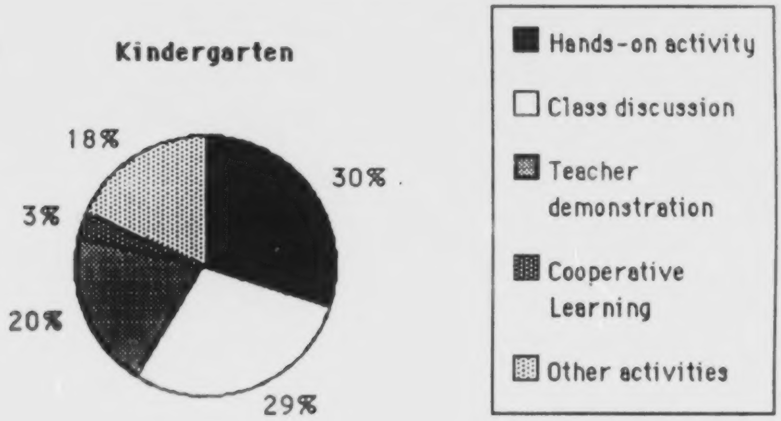
* Did not appear as a strategy on the teacher survey.

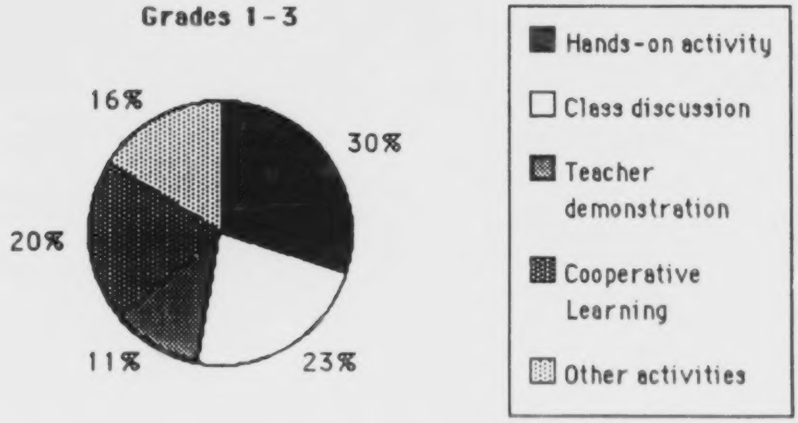
Sources: K-6 Science Evaluation Teachers' Survey, 1990
K-6 Science Evaluation Classroom Observations, 1990

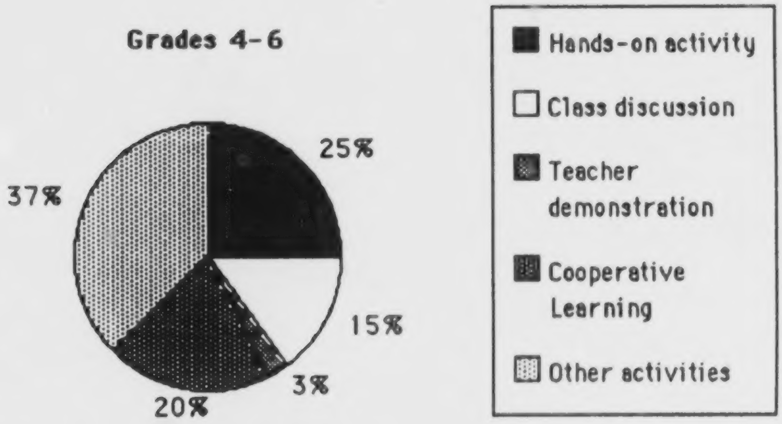
Hands-on activities and class discussion were found to be frequently employed as instructional strategies in both methods of data collection. Teachers reported via survey that they used textbooks more frequently than what was observed in classroom science lessons. Cooperative learning was also reported to be more frequently used than was observed by the consultant. Student involvement in experiments and activities was observed more frequently than it was reported by teachers to be used.

In classroom observations, the time devoted to each strategy was also recorded by grade groupings. From the percent of time observed of each strategy, the charts in Figure 3 compare the various use of strategies by grade groupings.

TIME OBSERVED IN INSTRUCTIONAL STRATEGIES
BY GRADE GROUPINGS


Kindergarten


Grades 1-3



Source: K-6 Science Evaluation Classroom Observations, 1990

Figure 3. Time Observed in Instructional Strategies by Grade Groupings

Two types of hands-on activities observed consisted of (1) experiments and (2) other activities, including observing and classifying plant or animal materials, drawing or diagramming, making a craft, or measuring and weighing. Hands-on activities were distributed fairly uniformly among the grade levels and were handled smoothly and efficiently by a majority of teachers.

Class discussions emphasizing open-ended questions were very frequently observed as part of a lesson with an experiment. Teachers posed questions to students which encouraged them to consider their observations and formulate conclusions. Discussion also accompanied review of text material or introductions to daily lessons and whole units. Class discussions with open-ended questions were found at all grade levels but were less frequent at the upper grades. Discussion periods were usually lively and challenging to students.

During teacher summary and student recitation sessions, the teacher leads the class through material being summarized or reviewed by posing a series of questions calling for many short, specific answers. Students either call out brief, usually factual, responses in chorus or are called upon to answer individually. This method was observed throughout the grade levels, although somewhat less in kindergarten lessons than in grades one through six. In most classrooms such activities appeared less lively than hands-on activities and class discussion, but still appeared to be productive.

Teacher demonstration of experiments was observed infrequently in the fourth through sixth-grade classes. When it occurred in any setting, this technique appeared to be highly effective. Teachers performed demonstrations smoothly and managed to generate student interest.

The use of an integrated curriculum was observed in about a third of the lessons. Most commonly, science instruction was integrated with art instruction. About half of the lessons related art or craft projects to the science material being studied. In the other half, math, language arts, and music were integrated with science instruction. Using an integrated curriculum was somewhat more common among kindergarten through third-grade lessons than in upper grades.

Cooperative learning groups were found across all grade levels except kindergarten. In most classrooms, students were obviously well-versed in cooperative learning and worked well with each other on their learning tasks.

Use of Additional Personnel

Special instructional strategies involving the use of personnel in addition to the classroom teacher were also examined via teacher survey and classroom observations. These included the use of parent volunteers, team teaching, specialized teaching, "switch teaching," and instructional aides. No parent volunteers were present during observed lessons. Likewise, no team teaching occurred in classrooms during observations, and was only reported by nine percent of the teachers as being used frequently. (Team teaching is defined here as two or more teachers planning lessons and units together and sometimes presenting them jointly.)

Specialized teaching occurred in the middle school "wheel" science classes and in the laboratory classes at math/science magnets. Teachers with special interest or background in science taught all the science classes at the middle level or provided science enrichment activities for all students in laboratory settings.

"Switch teaching" a procedure in which teachers exchange classes with each other for two or more subjects, was found in only two classrooms among the sample classrooms. Eight percent of teachers responding to the survey said they used switch teaching frequently.

Instructional aides were employed during science instruction in 26 percent of the classrooms observed. Aides were almost always used to assist children with hands-on activities during lessons. Typically, aides prepared materials for the classroom and at children's work stations while the teacher gave instructions or taught the lesson. In addition, the aide and teacher circulated among the children as children actually performed the hands-on tasks set before them. In only a few cases were aides performing clerical work during the science lesson.

Exemplary Science Instruction

> (There is) a widening gap between belief and practice in science instruction. Although teachers and principals say they believe hands-on activities are important, such activities decreased ten percent in elementary classrooms between 1977 and 1986.
>
> "Battling Scientific Illiteracy"
> Association for Supervision and
> Curriculum Development *Update*
> (June 1989)

The 1990 California Science Framework, considered by many science educators to be an outstanding model for science instruction, discusses seven important practices for an effective elementary school science program.

1. Provide a balanced curriculum in the physical, earth, and life sciences. Each subject should receive roughly one-third of the total class time for any given year.
2. Show students that science is enjoyable. The motivation process begins with teachers modeling a fascination with science and its dynamic presence in our daily lives.
3. Reinforce conceptual understanding rather than rote learning. Conceptual understanding is strengthened when students draw connections to daily experience, novel situations, and previously learned ideas.
4. Organize an articulated scope and sequence at the school level. Of the total time spent learning science, at least 40 percent should be involved in activity-based lessons.
5. Arrange the classroom setting and student grouping to optimize positive attitudes for learning science. Students should have opportunities to work in cooperative groups, perform investigations, manipulate science equipment, and follow safety precautions.
6. Integrate science with other subjects. The use of science to teach other fields has been shown to be quite successful in many exemplary elementary science programs.
7. Make full use of community resources. Students who may have less outside experience to draw on are enriched by community resource agencies and their personnel.

In classroom observations, the consultant looked for the presence of the exemplary characteristics discussed above. Table 6 lists these characteristics according to their frequency among sample lessons and references to framework practices are noted. Observations about content area (Practice 1) and community resources (Practice 7) were not appropriate to the observation process.

TABLE 6
Characteristics of Exemplary Science Instruction Observed in Lessons by Grade Groupings

Framework Practice #	Exemplary Characteristic	Percent of Lessons With Characteristic			
		All	K	Primary	Upper
2	All students are actively engaged.	82%	91%	91%	68%
4	Hands-on activities are used in the lessons.	65%	68% *	66%	64%
6	Students communicate/ write about science.	58%	36%	46%	81%
3	Children/teacher ponder and question.	49%	55%	57%	39%
6	There is evidence of integrated curriculum.	36%	45%	40%	29%
5	Cooperative learning groups are used.	31%	*		
2	Teacher models scientific process.	8%	* *		
3	Lesson related to real-world experiences.	9%	* *		
Number of Classrooms		77	11	35	31
*	This strategy was not subdivided by grade groupings.				
* *	Numbers too small to report by grade groupings.				

Sources: California Science Framework, 1990
K-6 Science Evaluation Classroom Observations, 1990

As Table 6 indicates, the various characteristics of exemplary science instruction as outlined by the 1990 Science Framework were found to some extent in the classroom lessons observed. The active engagement of students (enjoying science) was very frequently found in observed science lessons. In a related part of the study, children were observed to be most actively engaged during hands-on activities (82 percent) and teacher demonstrations (53 percent). Students were least involved during filmstrips or videos (20 percent), reading textbooks (7 percent) or lectures (0 percent).

Students were observed writing or communicating about science. Most lessons in grades K-6 called for student writing, while a smaller number called for student drawing. Drawing occurred more typically in the lower grades, writing in the upper grades. In the fourth, fifth, and sixth grades, a total of 81 percent of the lessons involved some student writing or drawing. Experiment and observation reports were frequent examples of the written assignments in these classes.

In kindergarten through third-grade levels, over half of all lessons involved children and teacher pondering questions about the science subject matter at hand. Only in fourth through sixth-grade classes was this characteristic found in fewer than half of the science lessons observed.

Sample science lessons were found wanting only in the categories of "teachers modeling the scientific process" and "relating lessons to real-world experiences". Increased teacher effort is clearly needed in these areas.

In summary:

- San Diego City Schools K-6 teachers have had more college preparation in science than the average teacher in the nation. They also feel more prepared to teach science than their counterparts nationally.
- Hands-on activities and class discussion were found to be frequently employed as instructional strategies by both teacher survey and classroom observation. Discrepancies in frequency were found in the use of textbooks, cooperative learning, and the extent of student involvement in experiments and activities.
- Strategies such as hands-on activities, class discussion, and teacher demonstration decreased from grades K-3 to grades 4-6.
- One-fourth of the classrooms observed had instructional aides, who assisted children with hands-on activities. Teachers without aides usually conducted lessons alone, without assistance from parent volunteers or teaming personnel.
- Many science lessons observed in the study demonstrated practices of exemplary science instruction. Science lessons were strongest in calling for the active engagement of all students and requiring that students write or otherwise communicate about science. Science lessons appeared weak in only two areas: teachers modeling the scientific process and relating lessons to real-world experiences.

3. How do teachers, administrators, students, and parents feel about the science program?

Attitudes Toward Science

> By the third grade, half of all students don't want to take science anymore; by the eighth grade, only one in five wants to keep going.
>
> "Not Just for Nerds"
> *Newsweek* (April 9, 1990)

Teachers and parents shared a belief in the importance of a strong elementary science program. Ninety-four percent of the teachers surveyed agreed that science is an important subject for all K-6 students. Parents strongly agreed, with 90 percent reporting that science is an important part of their child's education. Two parent comments illustrate that importance:

> "I feel science is so important because of the problems that our children will have to solve today and tomorrow (ecological). I also feel we are behind in educating our students in science concepts and strategies."
>
> "Science is extremely important for the future of our country and if we don't interest our children in their early years in the sciences, there won't be interest as they get older."

Despite their strong belief in the importance of science, only 31 percent of the parents surveyed felt that the school's program met their expectations for a good science curriculum. In their comments, parents called for the following. (Numbers in parentheses indicate the number of parents making the comment.)

- more time in hands-on activities for their children (12)
- additional time for teaching science (11)
- increased communication with them about the content of the science program (10)
- better facilities and equipment for teaching science (9)

Forty percent of the parents were not sure of the quality of the science curriculum. One parent commented, "I really don't know much about the science program since my child brings so little home!" The highest affirmation for the science program came from African American (47 percent) and Asian (43 percent) parents. Only 19 percent of the White parents surveyed were satisfied with the science program at their child's school.

About half the parents agreed that their children's classroom showed evidence of ongoing science activities. One fourth disagreed, and one fourth had no opinion. One said, "Other than having fish and an occasional plant, I know of no science being taught." One mother commented, "I'm at the school at least twice a week and I do not know or see any science projects or even seen (sic) my child's science book." African American parents (41 percent) were the least likely, and Filipino parents (67 percent) were the most likely to report having seen evidence of ongoing science activities.

Sixty-eight percent of the parents surveyed believe that the science program nurtures their child's natural curiosity. One parent's comment captures this belief eloquently:

> "Science provokes thoughts about the delicacy and intricacy of our environment, problem solving skills; it encourages our curiosity."

Filipino parents (85 percent) and Hispanic parents (72 percent) were more likely to agree with this statement than parents of other racial/ethnic groups. Only 49 percent of parents report that their child is challenged by the science program. Responses to this question ranged from 43 percent of Asian parents agreeing to 65 percent of the Filipino parents in agreement.

Overall, 70 percent of the parents surveyed report that their child shares his or her science experiences at home, with a high of 83 percent coming from Filipino parents. When asked whether their child uses knowledge from his or her science class in everyday living, 65 percent of the parents agreed. Again, agreement from Filipino parents (81 percent) was the highest of any parent group. In fact, Filipino parents were consistently more positive about their child's interest in science and their enthusiasm for science instruction than any other racial/ethnic group surveyed.

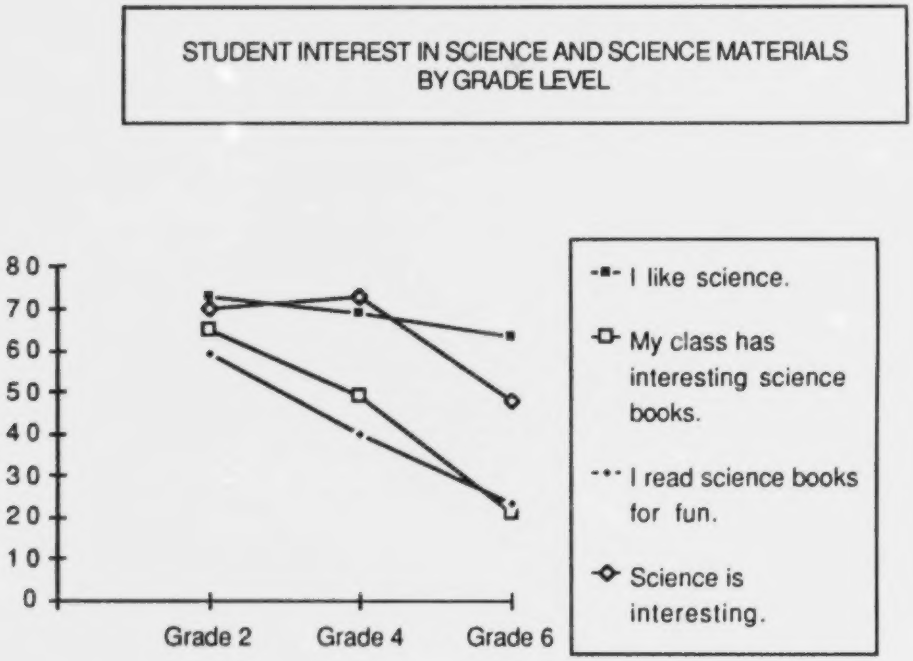
> As a nation, Americans seem to have convinced themselves that only a handful of smart students have the capacity to learn science.
>
> *Getting Started in Science*
> National Center for Improving
> Science Education (1989)

The data discussed above reveal that parents are concerned about science instruction for their children. This concern contrasts data from the principal interviews. Principals reported that parental input regarding priorities for science instruction has rarely been expressed strongly. Principals stated that parents are most concerned about the basic subjects of reading, mathematics, and language because those subjects are systematically tested and receive much publicity. Principals in a few schools were aware that parents considered science a high priority, while others did not know how parents felt about science instruction.

Seventy-five percent of the parents surveyed felt that their child enjoys science instruction and 69 percent of the students said that they like science. Students surveyed generally think science is interesting (64 percent), like to do science experiments at school (86 percent), and like to tell their families about what they learn in science (63 percent). African American students (71 percent) and Hispanic students (68 percent) are the most likely to tell their families about what they learn in science (compared to between 53 percent and 62 percent of other groups surveyed). Among the racial/ethnic groups surveyed, Filipino students consistently responded most positively to questions regarding interest and enjoyment of science. As noted above, this positive attitude is mirrored by their parents as well.

Results from the student survey indicate that two-thirds of second grade students find interesting books about science in their classrooms. This number decreases as grade level increases, with only one-half of fourth graders and one-fifth of sixth graders finding interesting science books in their classrooms. Again, a larger percentage of Filipino students (66 percent) reported reading science books for fun, compared to 30-40 percent of other racial/ethnic groups.

Figure 4 illustrates that positive student attitudes toward science decline as grade level increases. Students also report corresponding decreases in the number of interesting science books in their classrooms and the likelihood that they read science books for fun.


STUDENT INTEREST IN SCIENCE AND SCIENCE MATERIALS BY GRADE LEVEL

Source: K-6 Science Evaluation Student Survey, 1990

Figure 4. Student Interest in Science and Science Materials by Grade Level

Parents and students agree on the importance of science to future employment. Sixty-five percent of both parents and students surveyed believe that a strong background in science will prepare students for a good job. While the percentage of parents who agree with this statement remains stable as the grade level of the child increases, the percentage of students in agreement decreases. Table 7 reports this disparity.

TABLE 7
"A Strong Background in Science Will Lead to a Good Job"
Student and Parent Responses by Grade Level

Grade Level	Students Who Agree (N=1048)	Parents Who Agree (N=644)
Grade 2	86%	63%
Grade 4	65%	66%
Grade 6	41%	67%
Total Population	65%	65%

Sources: K-6 Science Evaluation Student and Parent Surveys, 1990

Another disparity exists in the perceptions of children about their parents' value of science. Although 90 percent of parents feel that science is an important subject, only 64 percent of the students reported that their families think it is important for them to learn science. Again, students at higher grade levels felt that their families placed less importance on learning science. Forty-one percent of sixth graders did not know whether or not their families valued science, compared to 22 percent of second graders and 30 percent of fourth graders.

TABLE 8
"My Family Thinks it is Important to Learn Science"
Student and Parent Responses by Grade Level

Grade Level	Students Who Agree (N=1048)	Parents Who Agree (N=644)
Grade 2	74%	89%
Grade 4	66%	94%
Grade 6	48%	90%
Total Population	63%	90%

Sources: K-6 Science Evaluation Student and Parent Surveys, 1990

School Site Goals for Elementary Science

The goals and expected outcomes of the district science program, as described in Question 1, include the understanding of content and application, promoting critical thinking, and developing positive attitudes toward science. Two-thirds of the principals interviewed said that their schools had developed schoolwide goals relating to science that went beyond district program goals. Many of these site goals are found in the the Program Quality/Integration Review Process (PQIR) self-studies and improvement plans. One-third of the principals reported no schoolwide goals relating to science. Teachers responding to the survey listed a variety of science goals at their sites. The following goals cited by teachers parallel the district goals.

- Teaching the district science curriculum (25)
- Integrating science with other curriculum areas (24)
- Expanding the amount of hands-on science activities (15)
- Increasing student enjoyment of science (6)

Some teachers commented that they were unaware of any specific site goals for science (34).

Conditions for Learning

School Site Facilities

Of the many factors that affect the quality of science instruction, the availability of facilities is a critical one. Fifty-two percent of teachers surveyed reported that facilities are either adequate or more than adequate to teach the district science curriculum at their sites. However, only 34 percent of the parents surveyed think that school facilities are adequate. Some parents, in their comments, compared the facilities of math/science labs to the basic facilities at their own school. Classroom observations revealed that most classrooms contained sinks and tables appropriate for group work. Half of the sixth grade classrooms at the middle school level had no tables and were not suitable for group work. In every case, classrooms that did not have appropriate areas for group work were sixth grade classrooms. Fourteen percent of classrooms (mostly in grades four through six) did not have sinks. A lack of running water may make it difficult to implement some of the hands-on science activities called for in the district science program. In addition, unavailability of tables may decrease the amount of group work occurring in some classrooms.

Science Instructional Materials

Principals report that teachers generally find the district curriculum materials adequate or even more than adequate to teach K-6 science. About two-thirds of the principals reported that teachers supplement the district curriculum with other materials, but the extent to which teachers do this varies with expertise and interest in science. According to the teacher survey, 55 percent of teachers use science trade books to supplement the science program. Classroom observations indicated that 66 percent of all classrooms had reference materials available to students, including science books.

In addition to the resources provided by the district and the school sites, 70 percent of the teachers surveyed reported they purchased materials to supplement the science program for which they were not reimbursed. Only seven percent of teachers are able to use school funds to purchase the additional materials necessary for various activities in the program. When a science activity required materials not readily available, 17 percent of teachers surveyed reported skipping the activity. One teacher explained why it is sometimes necessary to purchase additional materials, "The kits are inadequate. I need materials that WOW the students!".

Evidence of the Value of Science

The observations revealed that nearly three-fourths of all classrooms displayed evidence indicating that science was being taught and valued. The frequency of such displays was higher in the primary grades and decreased substantially by the sixth grade. Science learning centers were found in 21 percent of the classrooms, with most centers located in primary classrooms. Only three percent of the upper grade classrooms had science centers. One teacher commented that "the only way I can fit science in is to make a science learning center." The indicators used to determine whether science was being taught and valued in individual classrooms are shown in Table 9.

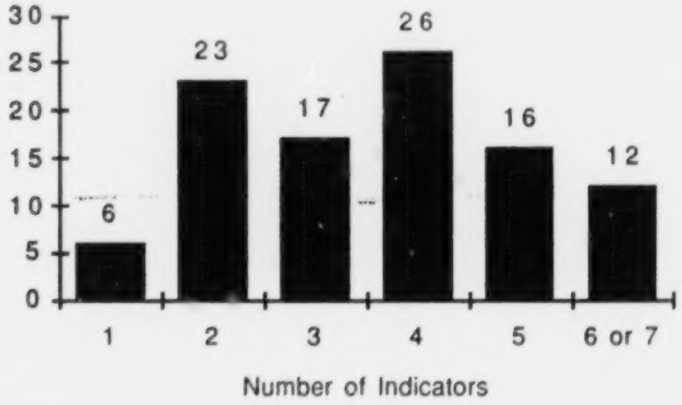
TABLE 9
Indicators that Science is Taught and Valued

Indicators	Description
Displays	Science posters, bulletin boards
Classroom Schedule	Science instruction scheduled consistently
Supplementary Books	Reference works, including science books
Computer Technology	Computer use across the curriculum
Exhibits	Animals, scientific exhibits
Student Displays	Science products of students displayed
Science Learning Centers	Independent science activities for students
Supplementary Science Materials	Scientific models and apparatus

Source: K-6 Science Evaluation Classroom Observations, 1990

The number of indicators found in classrooms varied considerably. Classrooms were given a score from zero to eight based upon how many indicators were found. Figure 5 provides a distribution of classroom scores which shows the range and wealth of evidence that science is being taught and valued.

OBSERVED CLASSROOMS EXHIBITING INDICATORS
THAT SCIENCE IS TAUGHT AND VALUED
(Mean Number of Indicators=3.65)



Source: K-6 Science Evaluation Classroom Observations, 1990

Figure 5. Percent of Observed Classrooms Exhibiting Indicators that Science is Taught and Valued.

Among the classrooms rated the highest on the table above were the science labs. They were by far the most richly endowed of the classrooms in the sample. These labs housed collections of exhibits and apparatus far surpassing the typical classrooms. However, science lab and pullout programs were unavailable to the vast majority (87 percent) of teachers, because most of these special programs are located only at science magnet schools.

Site-Based Cocurricular Science Activities

Cocurricular activities were often cited as supplements to the science program. Data from the principal interviews revealed that one-quarter of the schools are involved in national science programs such as "Invention Convention" and "Invent America!" Two-thirds of the schools offered an annual science or invention fair. One-third of the schools also involved students in such activities as a Math/Science Field Day, the Science Olympiad, and schoolwide Science Days. The science magnet school in the interview sample had the greatest variety of cocurricular activities in the area of science.

A review of Program Quality/Integration Review (PQIR) reports from 1988-89 and 1989-90 showed that several K-6 schools had developed on-going cocurricular activities in science. Of 47 reports, 27 identified cocurricular science activities. These often included field trips, site science clubs, Invention Convention, Invent America!, Science Olympiad, site science fairs, and science-related assemblies and speakers. One school sponsors a Young Astronauts Club while another sponsors an after-school *program called "Hands-on Science."*

Despite the number of cocurricular events enumerated by principals and PQIR reports, 71 percent of the teachers surveyed reported that they infrequently or never participated. In addition, only about one-fourth of the parents said that their children participate in school-sponsored science activities outside of the classroom. Another 25 percent were not sure of their child's participation, while nearly one-half (47 percent) reported that their child **did not** participate in such activities. Only 19 percent of White parents felt that their children were involved; Filipino and Hispanic parents (30 percent) were the most likely to agree that their children were involved.

Use of Technology

Seventy-three percent of students responding to the survey reported that they regularly use computers at school, although the use of computers was not specifically linked to science education. Second graders and sixth graders reported similarly high frequencies of use (75 percent and 79 percent, respectively); 64 percent of the fourth graders reported using computers. Only 55 percent of Asian students said they use computers at school, compared to 80 percent of Filipino children, who reported the most frequent use of computers.

Nearly 69 percent of the parents who responded to the survey reported regular use of computers by their children at school. Asian (27 percent) and African American (34 percent) parents reported the lowest frequency of use for their children. Three-fourths of the Filipino parents said that their children regularly use computers, which closely paralleled their children's reported level of use.

Classroom observations revealed that 45 percent of the sample classrooms had one or more computers. It was not always clear whether computers were being used in the area of science, because they were seldom in use during observed science lessons. However, results from the teacher survey indicate that computers are seldom associated with science instruction. Only ten percent of the teachers reported using computer software for science.

Constraints and Unmet Needs of Teachers Relating to Elementary Science

Several constraints relating to the science program were expressed by principals, teachers, and parents. Principals reported that teachers have little time to prepare for hands-on activities, and 73 percent of teachers said that they did not have adequate time to prepare for science instruction. Both principals and teachers felt that more extensive science kits are necessary to improve hands-on instruction. In addition, teachers report that the kits do not always have the materials needed to implement hands-on activities included in the science program.

Parents surveyed believed that class size was a major constraint affecting science instruction. Thirty-seven percent of the parents feel that current class size is not appropriate for effective learning in science. Over half the White parents surveyed felt that class sizes are inappropriate for learning in science, while much smaller numbers of other groups felt that their child's science class size is inappropriate.

Principals were asked if teachers reported any unmet needs relating to the district science program. One-third of the principals said that teachers expressed no unmet needs. The remaining principals reported the following unmet needs:

- More time to prepare and implement hands-on activities
- Fully-stocked science kits, complete with materials necessary for suggested activities
- Improved facilities for hands-on activities
- Hands-on demonstrations or inservices specific to the needs of grade level and student population

Teachers responding to the same question on the teacher survey listed the following as unmet needs:

- More time to prepare for science instruction (66)
- Better materials for hands-on activities (51)
- More and site and grade level specific science inservices to increase teacher expertise (27)
- Increased resources/funding to improve the learning environment (22)
- More up-to-date audio-visual materials (17)
- More support for co-curricular science activities (6)

Level of Comfort and Staff Development for Teachers

Level of Comfort in Teaching Science

> Chris left science for last. For several other subjects she used textbooks, but only as outlines. She taught science right out of the book; this was one of those texts that takes pains with the obvious and gives the complex short shrift. Chris didn't know much science and didn't usually enjoy teaching it. Sometimes she let creative writing encroach on science's time. About one day in ten she canceled science altogether and announced--to cheers--an informal art lesson. She often felt guilty about science.
>
> Tracy Kidder
> *Among Schoolchildren* (1989)

Interview and survey questions addressed the comfort level of teachers in elementary science. Only one-fourth of the principals interviewed reported that teachers were generally comfortable teaching the science program. The schools in which principals reported the highest teacher comfort level are those in which there is specialization. In these schools, teachers with special backgrounds or expertise in science were responsible for implementing hands-on activities or the entire science program. In contrast to the perceptions of the principals, 79 percent of the teachers surveyed reported feeling comfortable teaching science.

Observations in classrooms revealed high levels of teacher enthusiasm, as Table 10 displays. Those few classes in which teacher enthusiasm appeared low were restricted to fifth and sixth grade levels. In some of these rooms, problems of discipline and classroom order appeared to preoccupy the teacher and students, precluding enthusiasm for any subject matter.

TABLE 10
Teacher Enthusiasm about Science
in Observed Classrooms

Percent of Teachers Observed as Showing Enthusiasm in Teaching Science			
All Classes (N=77)	Kindergarten (N=11)	Primary (N=35)	Upper (N=31)
91%	100%	100%	81%

Source: K-6 Science Evaluation Classroom Observations, 1990

Staff Development Offerings

> Science is more a way of thinking than it is a body of knowledge. The development of the ability to think scientifically depends, in part, upon providing teachers the training they need to guide students through active discoveries.
>
> Bill Aldridge
> National Science Teachers Association

The Mathematics and Science Office of the Basic Education Department offers a wide range of staff development activities in science for teachers. For example, in 1989-90 classes or workshops were offered in the following areas:

AIMS (Activities to Integrate Math and Science, parts 1-5)
Invent America! Creativity Conference
Marine Science Project: For Sea
The Joy of Chemistry
Science and Art: An Integrated Approach
Silver Burdett Hands-on Science Workshop
Whalewatchers Have Class!

In May 1990, a workshop was held to discuss the organization and themes of the new state framework. Annually, the elementary science resource teacher sends out an inservice needs assessment to teachers. Staff development is then planned to address the needs expressed by the responding teachers. According to the science resource teacher, these classes quickly fill up with interested teachers. Sixteen percent of the teachers responding to the evaluation survey have participated in the district's Math and Science Office-sponsored Discover classes.

The current district science program was implemented across the district in the fall of 1986. When the textbook series was adopted, the district's Math and Science Office offered training to two representatives (one primary and one upper) from each elementary school site in the district. The training included information on the background of the adoption process, an overview of the Silver Burdett and district curriculum materials, and sample lessons with an emphasis on hands-on activities. The teachers receiving this training were expected to return to their sites and inservice their colleagues on the new district science program. In addition, the Math and Science Office offered paid Saturday workshops for all district teachers on the new curriculum.

When asked whether the district inservices on text adoption were helpful, 55 percent of the teachers reported that they did not attend. Fourteen percent said that the inservices were very helpful, and 27 percent said that they were somewhat helpful. Seventy percent of the teachers questioned said that they did not receive any follow-up training on the text adoption.

In addition to inservices on text adoption, the district Math and Science Office offered a number of workshops at the request of individual school sites. Only 30 percent of the respondents to the teacher survey reported attending such workshops. Eighty percent of the teachers attending inservices at their sites reported that, overall, they were either somewhat or very helpful. It should be noted that site leadership is responsible for scheduling science inservices and follow-ups. Teachers do not receive science inservice training unless requested by the site. The following table describes how well district inservices met the specific needs of teachers of elementary science, as reported by teachers.

TABLE 11
Degree to Which Teachers Felt Specific Needs Were Met by District Science Inservices
(N=494)

Teacher Needs	Very Well	Somewhat	Not At All
Use of Text	27%	52%	20%
Comfort Level	24%	53%	23%
Instructional Strategies	23%	57%	21%
Student Projects	24%	48%	28%
Overall	21%	67%	12%

Source: K-6 Science Evaluation Teacher Survey, 1990

When teachers were asked when they would prefer science inservices to be scheduled, half responded that they would prefer inservices on a professional growth day. Another 30 percent would like to see inservices scheduled on modified school days. The remaining teachers specified workshops during vacation, on Saturdays, or after school. One teacher said, "I would be very interested in attending a science workshop; it is my weakest area as a teacher."

Selection of Sequence and Materials for Multi-Grade Classes

Each grade level in the district science program has been divided into a two-year program consisting of two sequences, Sequence A and Sequence B. Every teacher is responsible for teaching one sequence, or 7-8 chapters each year. The chapters in each sequence have been selected to reflect a balance of life, earth, and physical science. Teachers alternate between Sequence A and Sequence B on a yearly basis. Fifty-six percent of the teachers surveyed reported following the district sequence guidelines.

Teachers in multi-grade classrooms use one textbook for both grade levels. In most cases (55 percent), teachers in multi-grade classrooms chose to use the district science materials for the higher grade level. Thirty-three percent reported using materials for the lower grade level, and 14 percent used materials for both grade levels. The selection of materials used in multi-grade classrooms can be determined by the materials available at the school site, the numbers of students at each grade level, or the instructional reading level of the students.

In summary:

- Less than one-third of the parents are satisfied with the science program at their children's school. Parents called for additional time for teaching science, better facilities and equipment for doing so, more time in hands-on activities for their children, and increased communication with them about the content of the science program.
- Principals are generally unaware of parents' concerns about the importance of science instruction for the elementary child.
- Parents have not successfully communicated their beliefs about the importance of science to their own children.
- Filipino parents and students are the most consistently positive racial/ethnic group in their attitudes concerning the value of science.
- Student interest in science appears to decline as grade level increases. This decline may be linked to fewer stimulating science-related materials, books, and exhibits in the classroom environment.
- School site goals for science reported by teachers and principals parallel the district goals.
- About half the teachers surveyed think that facilities at their sites are adequate for science; one-third of the parents agree. Sixth grade classrooms appear to be the least adequate facilities.
- Most of the classrooms observed showed evidence that science is taught and valued. Parents were less aware of the evidence of science teaching in their children's classrooms.
- Many schools extend classroom science instruction through cocurricular activities. A large number of teachers do not participate in the activities, and most parents do not think their children are participating.
- Computer use appears to be common in K-6 classrooms, but its use is not directly tied to science instruction.
- Teachers report needing more time to prepare for and implement science lessons. Teachers believe that instructional supplies and inservices tailored to meet their specific needs will lead to improved science instruction.
- The district offers many opportunities for professional development in science for elementary teachers, but few teachers acknowledged their participation. The district's Math and Science Office makes a concerted effort to offer courses that assist teachers in improving their science programs.
- Inservices are designed to help teachers implement the district program, use a variety of instructional strategies, and extend the curriculum with interesting enrichment activities.
- Only 30 percent of the teachers surveyed reported attending a science inservice at their school site. Since science inservices are scheduled at the request of individual

schools, site leadership is responsible for including science in staff development plans.

- Teachers report that science kits do not always contain the materials needed to implement hands-on activities included in the science program. However, 44 percent of the teachers surveyed do not follow the district sequence guidelines. Since supplies in the kits are aligned with the sequences scheduled for each school site, teachers not following the sequence guidelines will not have adequate materials.

4. How is science incorporated into the daily program?

Allocation of Time to the Elementary Science Program

A Survey of State Initiatives to Improve Science and Mathematics Education, prepared by the Education Commission of the States in 1987, reviews time allotments for elementary science in all 50 states. The study found that a wide range of minutes of science instruction per week existed among states. For example, Connecticut required a minimum of 75 minutes per week in grades 1 through 3, while California recommends 100 minutes per week in grades K-3 and 150 minutes in grades 4-6. Another national survey in 1987 revealed that the average primary teacher spends 19 minutes a day on science; teachers of grades 4-6 spend an average of 38 minutes on science daily, but lecture and discussion take up more three-fourths of that time.

Ideally, what should the time allotment be? The National Science Board, in its 1983 report, Educating Americans for the 21st Century, advocates a minimum of 30 minutes per day of science in grades K-6.

San Diego City Schools' Course of Study, K-12 provides guidelines for time allotment for science instruction in the elementary grades. In grades one through six, science and health share an instructional time block, with science taught three-fourths of the year and health one-fourth. The chart below shows the minutes per week of science instruction suggested for each elementary grade level.

TABLE 12
Suggested Minutes per Week of Science Instruction
at the Elementary Level

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
100 minutes per week semester one & 100-150 minutes semester two of science and health instruction	85 - 150 minutes per week of science instruction		135 - 140 minutes per week of science instruction			

Source: San Diego City Schools Course of Study, K-12

In addition to the Course of Study, K-12, the Educational Services Division provides elementary schools with guidelines on time allotments for various subjects. Administrative Circular Number 16, "Allotment and Weekly Schedule," (August 6, 1990) specifies 110 minutes of science instruction per week in Kindergarten, 85-150 minutes per week in grades 1-2, and 135-140 minutes per week in grades 3-6. For the purposes of this study, the Educational Services Division guidelines were used to determine whether students were receiving an appropriate amount of science instruction.

The weekly schedules of 542 teachers at 28 schools were reviewed so that minutes per week of **scheduled** science instruction could be determined for each classroom. Overall, K-6 classrooms averaged 120 minutes per week of scheduled science instruction. Kindergarten classrooms averaged approximately 100 minutes per week of science instruction; primary classrooms 110 minutes, and upper grade classrooms 128 minutes. Sixth grade classrooms located at middle school sites averaged only 65 minutes per week of science instruction compared with 121 minutes per week for sixth grade classrooms located at elementary school sites. There were no differences found in the average number of minutes of science instruction scheduled in classrooms of male and female teachers.

When comparing minutes of science instruction found on teachers' weekly schedules with suggested time allotments for each grade level provided by the Educational Services Division, it was found that 57 percent of the classrooms met or exceeded district suggestions. Forty-one percent of the classrooms did not meet the minimum district guidelines for science instructional minutes.

Teachers responding to the teacher survey were asked to report the **actual** number of minutes they spent teaching science in their classrooms. Teacher responses differed from the information gained from the teacher schedules. Table 13 compares actual minutes of science instruction as reported by teachers on the survey, with minutes of science instruction recorded on teachers' weekly schedules, and amount of science instruction recommended by the Educational Services Division.

TABLE 13
Mean Reported Minutes of Science Instruction
Compared to Mean Scheduled and Recommended Minutes
by Grade Groupings

Grade Level	Reported Minutes (Survey)	Scheduled Minutes (Schedules)	Recommended Minutes
Kindergarten	86 (N=60)	100 (N=37)	110
Primary	107 (N=161)	110 (N=134)	85-150
Upper	125 (N=247)	128 (N=261)	135-140

Sources: K-6 Science Evaluation Teacher Survey, 1990
Document Review, 1989-90

Differences by School Type

One question posed by board members for this evaluation concerned any differences between Achievement Goals Program (AGP) schools and non-AGP schools. In terms of allotting time to science, AGP suggests no different allotments for time. AGP schools use the same state standards as guidelines as every other school with respect to science instruction. In the examination of teacher weekly schedules, however, it was found that AGP classes had a mean of 109 minutes per week of science, and non-AGP classes had a mean of 126 minutes per week.

The review of teacher schedules also found that classes in both restructuring schools and in non-restructuring schools had a mean of about 120 minutes per week of scheduled science instruction.

Teachers in schools with math/science magnets scheduled the same number of minutes per week (120) for science instruction as teachers in non-magnets. However, that time did not include lab experiences, which are typically conducted outside the classroom setting. A student in a magnet situation may receive as many as 90 additional minutes per week in lab instruction related to the magnet focus.

Differences by Program Type

The number of minutes of scheduled science instruction by program type contrasted with minutes reported on teacher surveys is shown in Table 14.

TABLE 14
Mean Number of Minutes Per Week of Scheduled Science Instruction
by Program Type
as Reflected in Teachers' Schedules and Surveys

Program Type	Mean Minutes (Schedules)	Mean Minutes (Surveys)
Regular	124	111
Bilingual (English/Spanish)	113	107
G.A.T.E.	134	125
Special Education	110	116
Middle School "Wheel"	73	*
Total Population	120	115

* No Data Available

Sources: K-6 Science Evaluation Document Review, 1990
K-6 Science Evaluation Teacher Survey, 1990

Differences in Scheduling

Teacher schedules and teacher survey information were used to determine how science instruction was scheduled in K-6 classrooms. Most teachers (73 percent) reported that they teach science as a single subject. Of those teachers, about half teach science daily while the other half teach science using block scheduling. In block scheduling a teacher plans science and social studies instruction in two to three week blocks, utilizing longer class periods to present lessons during each block. Integration of science with other subject areas was used by 23 percent of the teachers; while three percent report that science is taught by another teacher in a switch-teaching situation. One teacher describes a team teaching arrangement.

> "I am a sixth grade math/science teacher. I team teach with a partner who teaches reading/language. This allows me to concentrate on science instruction. We have our own curriculum plan."

At elementary school sites, 75 percent of all science instruction occurs in the afternoon. Only 16 percent of the classroom schedules studied indicated that science is taught in the morning. Examination of sixth grade science schedules at middle school sites shows that science is taught as part of an exploratory "wheel." Students rotate through various exploratory subjects in five or six week blocks during the course of the school year.

Science is one subject included in the wheel, with other subjects as keyboarding, Spanish, and Art/Music.

Innovations in Elementary Science Instruction

The majority of principals interviewed indicated that innovative science activities were taking place at their school sites. Three-fourths of the principals mentioned the expansion of the hands-on component of the science program, including a garden maintained by second graders at one school, daily experiments by sixth grade students, comprehensive science learning stations for independent activities, and an upper grade "Science Day" where students experience a variety of active, hands-on activities. Principals also considered school-wide science fairs to be an innovative addition to the science program. One-quarter of the principals interviewed mentioned the integration of science with other subject areas as innovative.

Some of the principals interviewed restricted their remarks on innovation to the efforts of teachers who specialize in science instruction. The specialized teachers may be few in number in proportion to the total staffs at their respective schools, but they expose many students to unique and innovative activities. In magnet schools especially, these teachers have access to well-equipped laboratory classrooms which allow them to better implement elaborate hands-on activities.

Twenty-one percent of the teachers surveyed reported that the science program included unique or innovative elements at their site. Several of these teachers attributed innovations at their school to specialized science teachers or lab programs. Others mentioned special programs or activities that they implement in their own classrooms.

Based on the comments of teachers and principals, schools with classroom and lab teachers who specialize in science tend to offer students a more innovative science program.

In summary:

- Time scheduled for science instruction in elementary classrooms generally met the district guidelines. Some differences were noted when comparing various school and district program types. AGP classrooms were found to schedule fewer minutes per week of science instruction, even though they follow the same standards and guidelines as other schools. Classrooms in magnet schools scheduled the same amount of time in general science instruction as non-magnet schools, but were able to expand the curriculum with the help of specialized teachers and programs.

- The most dramatic difference in time scheduled for science instruction was found when comparing sixth grades at middle schools with sixth grades at elementary schools. Middle school programs scheduled only half as much time for science instruction as elementary school programs.

- Science is most often taught as a single subject in the afternoon. Half the teachers conduct daily science lessons; the other half use block scheduling to teach science less often but for a longer period.

- One-fourth of teachers regularly integrate science with other subject matter.

- A number of innovative science practices were reported as occurring at sites, but most of these were attributed to the efforts of specialized science personnel.

5. How do district elementary teachers utilize community resources?

Teacher Inservice Opportunities

San Diego is fortunate to have a wealth of resources to spur curiosity in science. One teacher-training program is especially worth highlighting. The University of California at San Diego (UCSD) offered a three-year Elementary Science Teacher Institute to instill a love of science in San Diego County's public school teachers. The institute brought 100 teachers together with science scholars and Nobel prize winners for five weeks each summer. The teachers participated in hands-on experiments, broadening their base of comfort with science activities and expanding their ideas of how to teach the subject. For example, one teacher used a peanut butter sandwich to demonstrate the movement of the earth during the 1989 San Francisco earthquake. Twenty district teachers completed the three-year program.

A list of community resources developed by the district's Math and Science Office identifies over 30 science-related resources in the San Diego area. According to the teacher survey, teachers have made use of community resources to stay current in science. Teachers most frequently took advantage of community workshops (49 percent), university classes (24 percent), and to a lesser extent, inservices at the San Diego County Office of Education (9 percent). Teachers reported taking advantage of the Joy of Chemistry workshop (sponsored by the San Diego section of the American Chemical Society and San Diego City Schools), AIMS (Activities To Integrate Math and Science) workshops, Humane Society programs, NASA materials, Project Wild activities, tours of the Natural History Museum, Project 2061 workshops, and other such events.

Student Interaction Activities

An added enrichment experience for district elementary students is the Off Campus Integrated Learning Experiences (OCILE) Program conducted by Community Relations and Integration Services Division. All district fifth graders spend a week in Balboa Park, and all sixth graders spend a week at Camp Palomar. Because these programs are outside the purview of the district's Math and Science Office, they were not examined in this study. However, they do serve as real-world experiences in science for district youngsters and should not be omitted in a discussion of community resources.

Community Involvement in Cocurricular Activities

A review of district Staff Bulletins show that some community-involved cocurricular activities relating to science are occurring at some district elementary schools. For example, Southern California Edison and Invent America! sponsored a performance in which Thomas Edison encouraged Johnson Academy for Space Exploration and Technology students to use their imaginations and be young inventors. The Dewey Elementary School Young At Art program coordinator and students completed an ecology-related mural at the school.

Partnerships In Education

According to the Community Relations and Integration Services Division (CRISD), business/community partnerships enrich the district science program by forming science-related partnerships with 15 elementary schools and one middle school. The following partnerships provide examples. (1) Sea World actively supports the Emerson Center for Marine Science by providing for staff development and curriculum design. In addition, Sea World sponsors field trips for Emerson students. (2) As a part of the partnership agreement between Knox Academy for Written, Oral, and Visual Communication and General Dynamics, science fairs were held. General Dynamics provided trophies, donated some materials for projects, and assisted with the judging of student projects. (3) UCSD Medical Center has collaborated with Grant Elementary School in several ways. The Medical Center contributed prizes to the school's jog-a-thon, participated in Grant's health fair, and provides speakers when requested. Grant students have toured the Medical Center, visiting patients and delivering holiday gifts and cards.

Student Interaction with Local Scientific Community

About eight percent of the teachers surveyed indicated that their students work with the local scientific community either occasionally or frequently. Resources specifically mentioned included: I Love a Clean San Diego, Elementary Science Institute, San Diego Zoo, Scripps Institute of Oceanography, and Sea World.

In summary:

- A wide variety of science-related resources are available to teachers and students in San Diego, both in the community and through district programs. Nearly half of the teachers surveyed reported taking advantage of community workshops in science.
- Partnerships with scientific community organizations provide opportunities for students to interact with scientists, and for schools to receive support for their science programs.

6. What is the degree of student learning in science?

Importance of Science as Subject Matter

The teacher survey inquired as to the importance of science as subject matter for elementary students. Fully 94 percent of the K-6 teachers surveyed agreed that science is an important subject for the children in their class. They did not think that science was too hard for children to understand. Three-fourths of the respondents did not agree that "science is a difficult subject for all students to master". Eighty percent of the kindergarten and primary teachers disagreed with that statement; 71 percent of the upper grade teachers disagreed. Students themselves were not as sure about their degree of mastery in science. While 69 percent of the students said they like science, only 49 percent think that "science is easy."

Reporting Pupil Progress in Science

Teachers were asked on the survey to report the frequency with which they use certain methods to assess student progress in science. No single method was identified as being used frequently by a majority of teachers, although the publisher's test (with or without the essay question) was used regularly by 45 percent of the teachers. This finding is somewhat surprising, since only 22 percent of teachers had rated the commercial tests as being of above-average quality. Table 15 shows assessment methods used most frequently by teachers.

TABLE 15
Assessment Methods Used Most Frequently by Teachers

Type of Assessment	Reported Frequency of Use by Teachers
Publisher's Test (with or without essay)	45%
Science Projects	25%
Activity or Lab Assessment	22%
Teacher-Made Test (with or without essay)	22%
Science Homework	21%
Student Portfolios	17%

Source: K-6 Science Evaluation Teacher Survey, 1990

All elementary report cards contain a section concerning pupil progress in science. Only 40 percent of the parents responding to the survey agreed that their children's progress is regularly reported to them. Two parents commented on the lack of communication about progress in science:

> "I am aware of what the science program is. I communicate regularly with my child's teacher. But we discuss other subjects, e.g., reading and math. Science is never discussed which leads me to believe that school does not consider it important."
>
> "Most progress report cards state for science, 'not evaluated at this time'. So how can anyone evaluate the school program if it is being stated that they are not doing daily science lessons?"

Recognition of Students in Science

Most educators agree that an element that demonstrates and motivates student learning is student recognition for their activities in science. The district's Staff Bulletins were reviewed for the period 1988-90 to look for examples of student recognition. In all, eight references were found related to the achievement of children in grades K-6 in science. These included

- state and county winners in "Invent America!" competitions,
- local and national winners of Elementary Science Olympiads,
- recognition of a child whose essay on the environmental dangers of Styrofoam was chosen to air on PBS, and
- first-place winners in the National Energy Education Development Project.

Teachers were asked in the teacher survey about student recognition in science at their sites. Sixty percent responded that students were never or infrequently recognized for science at their schools. About 24 percent of the teachers estimated that recognition occurred occasionally, and 15 percent said it occurred frequently. Most teachers connected recognition opportunities to science fair awards. One teacher said:

> "I enjoy teaching science. My students absolutely love science. I prepare my whole class for the Science Olympiad sponsored by the county. I feel bad that the school doesn't recognize this event--all of it is left up to me and the parents. I think the school should recognize them with a special diploma or some other recognition."

Traditional Methods of Student Assessment

> The issue of teaching to the test will become moot: if the content is worthwhile, teaching to the test is worthwhile.
>
> *Getting Started*
> National Center for Improving Science Education
> (1989)

Assessment methods in the elementary school curriculum have received considerable attention recently. While most educators agree that testing has a proper place in any curriculum, including science, a number of issues are hotly contested:

(1) concern about the influence of testing on curriculum,
(2) poorly-constructed tests,
(3) over-testing, and
(4) test fairness.

Standardized tests in elementary science are now given in more than half of all states, usually in grade 3 or 4. In California, tests in science are being developed for elementary students by the state testing program. The California Assessment Program (CAP) will align the tests with statewide curriculum objectives in science and will use the results to achieve state educational reform goals. Assessment in Elementary School Science Education (National Center for Improving Science Education, 1989) uses the following matrix to summarize the reasons assessment takes place in science education:

TABLE 16
Reasons for Assessing Student Science Learning

	Improvement	Conveying Expectations	Monitoring Status	Accountability
Teacher	Classroom Instruction	To Students and Parents	Of Individuals and Class	
Policy Makers	Program in District	To Teachers Administrators	Of District, State, Nation	Effective Use of Resources

Source: National Center for Improving Science Education, 1989

Several tests monitor the status of science programs in the nation, and, as stated earlier, student achievement on these tests has been disappointing. It appears that U.S. students do not demonstrate a level of science scholarship comparable to students in other countries, nor do they demonstrate an ability to excel in problem-solving types of test questions.

> It is estimated that over ninety percent of test questions the U.S. public school students are now expected to answer deal with little more than information.
>
> Benjamin Bloom (1984)

Traditional student assessment measures have focused on simple recall. The example which follows is taken from a test developed by the International Association for the Evaluation of Education Achievement in science for ten-year-olds:

> Flowers cannot usually produce seeds unless
>
> (A) They are visited by insects.
> (B) They appear in the summer.
> (C) They are on plants growing in good soil.
> (D) They produce nectar.
> (E) Suitable pollen is placed on their stigmas.
>
> The correct response to this relatively difficult item is option E. Levels of correct response ranged from 12 percent in Norway to 60 percent in Korea. Twenty-eight percent of U. S. students chose the correct answer.

Another example of traditional testing comes from the National Assessment of Educational Progress (NAEP) in science for fourth graders:

> A scientist discovers a new type of fish and wants to learn more about it while it is alive. How should the scientist do this?
>
> (A) Go to the library and read about fish.
> (B) Watch television programs about fish.
> (C) Observe the fish.
> (D) Dissect the fish.
>
> The correct response to this item is option C.

New Methods of Assessment in Science

> Given the profound influence of indicators of achievement, we should develop new kinds of indicators so that teaching to the test means doing a better job of teaching an understanding of science concepts, procedures, and problem-solving strategies.
>
> Shavelson, Carey, and Webb
> "Indicators of Science Achievement"
> *Phi Delta Kappan* (May 1990)

The district's Course of Study, K-12 identifies assessment as an "ongoing process" that may take several forms: written tests, lab activities, student projects and demonstrations, oral reports, and discussions. This much broader view of testing reflects the district's commitment to explore and develop alternative assessment measures. Students in San Diego City Schools participated in two science assessment activities during 1989-90 which model the vision of assessment outlined in the 1990 Science Framework.

1) California Assessment Program (CAP)

CAP has been a national leader in changing the format of large-scale testing and seeks to assess children's progress by using real-world tasks. CAP demonstrates the philosophy of aligning assessment with curriculum and instruction in its basic skills tests. The CAP sixth-grade science pilot assessment encourages students to "discover" and "construct," through inquiry and investigation, important ideas in science. A sample open-ended question from the sixth grade pilot follows:

> A small tree is planted in a meadow. After 20 years it has grown into a big tree, weighing 250 kg more than when it was planted.
>
> Where do the extra 250 kg come from? Explain your answer as fully as you can.

In 1989-90, CAP piloted performance tests in science in sixth grade, consisting of five performance tasks. Seven district schools participated in the pilot test. Until the recent budget controversy concerning CAP, it was expected that CAP would continue to develop open-ended and performance-based items for its science tests.

2) New York State Elementary Science Program Evaluation Test (ESPET)

> At first glance the (ESPET) classroom looks more like a kindergarten than the setting for a grade four science test. The balances catch the attention at once -- five of them, apparently randomly distributed across the five rows and five columns of the desks. . . . But if the materials make you think of a kindergarten, the almost silent concentration of the children sitting at the desks dispels the impression. They have the absorbed expressions of problem solvers happy at their work.
>
> Ruth Mitchell
> Council for Basic Education
> (1989)

As a part of the K-6 science evaluation, 39 district staff were trained by the State of New York Science Bureau in the manipulative skills portion of the ESPET assessment. This test had been used in 1988-89 with 211,000 fourth graders in New York--virtually every fourth-grade child in all public and private schools in the state. ESPET was used to examine district science programs for areas of strength and weakness, **not** as a student achievement test. The advisory committee to this evaluation recommended that ESPET would be useful to the district as a practical example of performance-based assessment and as a valuable tool for program evaluation.

ESPET was administered in either English or Spanish by trained personnel. Each class of fourth graders rotated individually among five stations, remaining at each station for seven minutes to perform the task and record their observations and results.

Briefly, the stations contained activities in the following areas:

Station 1:	Measuring Objects
Station 2:	Observing and Predicting
Station 3:	Classifying Objects
Station 4:	Generalizing from Activities using Electrical Conductivity
Station 5:	Inferring and Interpreting Data about an Unknown Object

District personnel administering ESPET found students to be initially somewhat hesitant about taking "a science test." However, when they entered the testing room with all the materials arranged before them, the students quickly became excited about participating. Some did not believe that this was a test, announcing "It's too much fun!" It was common to find students unfamiliar with the apparatus or unsure of having permission to touch things. Generally, once the students relaxed, they became very involved with the tasks at their stations and handled the materials more easily. For the most part, even those students who were unfamiliar with materials, found that seven minutes per station gave them enough time to figure things out. When finished, many students asked if they could do ESPET again or if the test administrators could bring out some other things for them to do.

The classroom teachers at the sites were invited to visit the testing room and to observe the test if they desired. Several teachers chose to do so and were impressed with the abilities of their children to persist with the required tasks. One school administered the test in the morning and allowed parents to visit the testing room in the afternoon during a site Open House. The principal reported that parents were very pleased to see such hands-on science activities for their children.

Locally, 1738 students from 23 elementary schools took ESPET in the spring of 1990, including 869 males and 864 females. LEP students taking the test in English needed to be working in Unit 18 or higher in ELEPS. The ethnic composition of the sample closely mirrors that of the district's K-6 population.

TABLE 17
Comparison of Racial/Ethnic Composition of ESPET Participants
with District K-6 Population, 1989-90

Racial/Ethnic Group	% in Sample	N	% in District K-6 Population
African American	15%	253	17%
Asian	3%	58	2%
Filipino	6%	94	8%
Hispanic	27%	460	27%
Indochinese	7%	123	7%
White	41%	699	38%

Sources: District ESPET data, 1990
District's Pupil Ethnic Census, 1989-90

The sample group was atypical in one area of student population. It contained 15 percent Gifted and Talented Education (GATE) students, compared to eight percent GATE students found in the total district population.

The mean total score for the State of New York was 13.3 out of a possible 22, slightly higher than the mean score of 13.0 achieved by students in San Diego City Schools. No comparisons are available about gender and ethnicity in the New York data because data were not collected for those variables. The skills with which the district program showed the most strength are shown below. Percent of student mastery refers to the percent of students able to correctly complete the item.

TABLE 18
ESPET Results for San Diego City Schools

Skill Tested	Station #	Percent of Student Mastery
Making inferences about shape	5	88%
Working with electrical circuits	4	81%
Observing	2	77%
Measuring temperature	1	69%
Measuring length	1	68%
Interpreting data from a data collection activity	5	64%
Predicting	2	60%
Classifying	3	49%
Measuring mass	1	48%
Making inferences about sounds	5	45%
Interpreting data from an experiment	2	44%
Generalizing	4	37%
Measuring volume	1	35%
Making inferences about property	5	30%

Source: District ESPET data, 1990

Overall, San Diego City Schools males and females scored similarly, with mean scores of 13.00 and 13.06, respectively. However, within individual stations, some gender differences emerged. Girls were more successful in observing and predicting, measuring temperature, classifying objects, and in interpreting data. Boys had greater success in manipulating electrical circuits, measuring mass, and in making inferences.

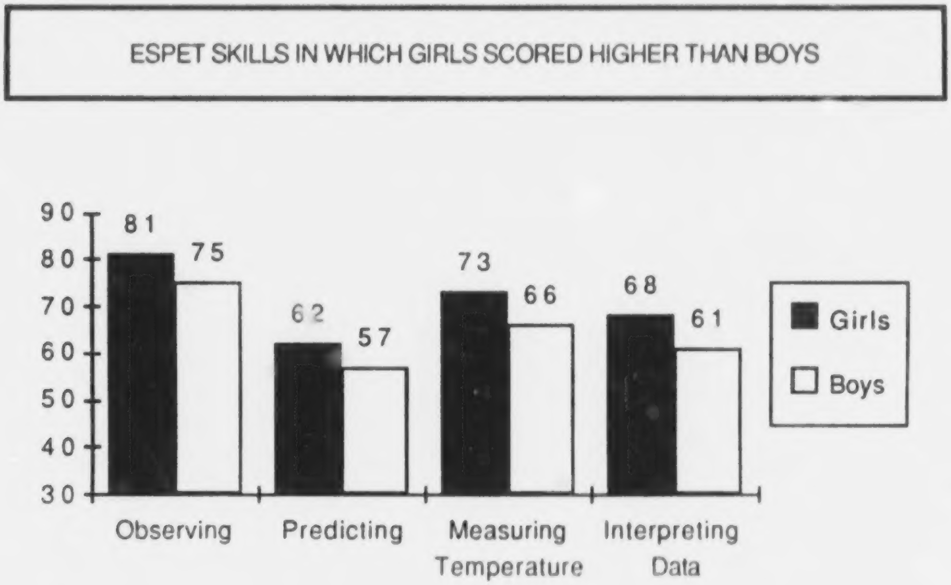


Figure 6. ESPET Skills in which Girls Scored Higher than Boys

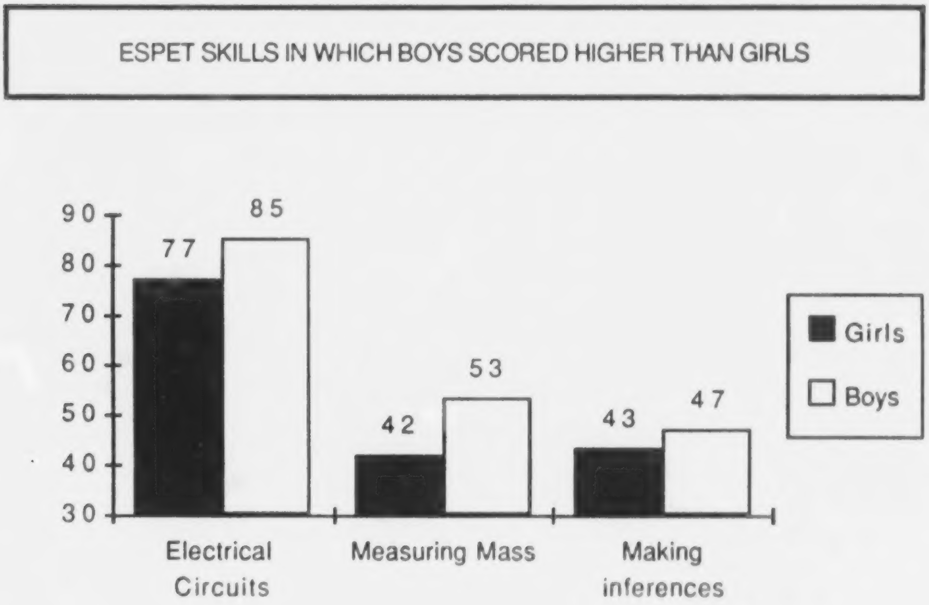


Figure 7. ESPET Skills in which Boys Scored Higher than Girls

Among racial/ethnic groups, Whites had the highest mean scores (15.3), followed by Filipinos (14.3), Asians (13.40) African Americans (11.6), Hispanics (10.8), and Indochinese (10.5). For the most part, these differences were maintained across all skill areas. (The appendices to this report contain a full accounting of skill mastery by gender and racial/ethnic group.)

Scores were also examined by various aspects of school organization. Table 19 shows the differences in mean scores by types of school. Students in the math/science magnets had a higher mean score than students in non-math/science magnets. Those in AGP schools scored lower than non-AGP schools. Restructuring schools scored slightly higher than non-restructuring schools. There is some overlap in the assignment of schools to school types. For example, a single school might belong to more than one category. Johnson Elementary is a science magnet and is also an AGP school. Individual schools received data profiles with the mean scores for each station.

TABLE 19
Mean ESPET Scores of Grade Four Students
by School Type/Organization

School Type or Organization	N	Mean Scores of Participating Schools	N	Mean Scores of Non-Participating Schools
Science Magnet	3	14.3	20	12.9
AGP School	7	11.6	16	13.7
Restructuring School	10	13.5	13	12.8

Source: District ESPET Data, 1990

The use of ESPET provided valuable information about the strengths and weaknesses in the district science program. In comparison to New York students, San Diego fourth graders scored high in inferential skills, were about evenly matched in observing and predicting, and scored lower in measuring, classifying, manipulating materials, and interpreting data.

In summary:

- Teachers, parents, and students all think that science is an important subject. Most teachers feel that all students can master science, but only half the students think that science is easy.
- The most frequently used method of assessing pupil progress in science is the publisher's test (with or without the essay question).

- Recognition in science infrequently occurs at sites and in the district's Staff Bulletins. Enthusiasm for science would receive a boost by increasing opportunities to recognize the science achievements of students.

- While there are appropriate reasons to assess student learning in science, most traditional tests only tap the lowest levels of student knowledge.

- The district's Math and Science Office has been supportive of alternative assessment methods in the area of science and was instrumental in funding district teachers to participate in the ESPET training, assessment, and scoring session.

- District ESPET results show that district students performed comparably to New York State students on ESPET. San Diego fourth graders scored high in inferential skills, were about evenly matched in observing and predicting, and scored lower in measuring, classifying, manipulating materials, and interpreting data.

  While girls and boys had very similar total mean scores, some gender differences were noted in individual skills. Girls were more successful in observing and predicting, measuring temperature, classifying objects, and in interpreting data. Boys experienced greater success in manipulating electrical circuits, measuring mass, and in making inferences.

  Among racial/ethnic groups, Whites had the highest mean scores, followed by Filipino, Asian, African American, Hispanic, and Indochinese students. For the most part, these differences were maintained across all skill areas.

  Students in the math/science magnets had a higher mean score than students in non-math/science magnets. Those in AGP schools scored lower than non-AGP schools. Restructuring schools scored slightly higher than non-restructuring schools. School categories were not mutually exclusive; some schools belonged to more than one category.

7. How do schools compare within the district?

This section does not include comparisons of time allotments, examined in Question 4 (pages 38-39) and comparisons of student achievement (pages 50-51), examined in Question 6.

Science Programs in Restructuring Schools

The basic district program in science has been implemented in all schools studied. However, some schools have modified their instructional delivery in order to enrich the children's learning experience in science. On the teacher survey, 25 percent of the teachers from restructuring schools said that their schools made or were planning to make changes in the way science instruction is conducted at their sites. Comments by the teachers included the following recommended changes (Parentheses show the number of respondents making that comment):

- Integrate science with other subjects by incorporating reading, health, and language arts (6).
- Use team teaching at some grade levels (2).
- Use a wheel format in the afternoon with one person doing all science (2).
- Hire a science teacher to provide 90 minutes of science per classroom every other week (1).

Some schools have made improvement in science instruction a major focus of their restructuring efforts. Principals indicated that restructuring science programs have not yet yielded measurable results. In some schools, science is considered a relative strength already and it is difficult to determine what differences might be. In other schools, it is too early to tell what changes will eventually be realized in the area of science. Descriptions of a few restructuring science programs follow:

Hamilton Elementary, a multi-track year-round school, has reorganized into four autonomous schools or houses. Track D students are enrolled in the School of Science for a Socially Responsible World. Quarterly scientific themes will be taught through experiential learning with hands-on activities and utilization of the investigative process.

Jefferson Elementary, with support from a local businessman, has developed the Windows on the World Education (WOWE) program, focusing on environmental issues. Children study about the earth's environments and ecology in an effort to stimulate their interest in science and technology and related environmental issues facing mankind. Classroom teachers developed the program themselves, with support from local and national specialists from scientific, environmental, and arts organizations.

Jerabek Elementary supplements its classroom science instruction with a science lab where students use scientific principles to pursue their own investigations. The principal reported that the lab staff also serve as models and resources for classroom teachers, encouraging their greater use of hands-on activities in their own rooms. The staff has identified a schoolwide goal of providing opportunities to children for scientific challenges. Jerabek participates in science fair activities, Science Olympiad, Invention Convention, and Young Astronauts Program. The school's Science Day was devoted to hands-on activities in astronomy, chemistry, electricity, clay boats, straw structures, oceanography, estimation, and geology. Students could choose to participate in five one-hour classes during the day.

Linda Vista Elementary has developed a wheel format similar to the exploratory wheel used in middle schools for afternoon instruction. One teacher conducts science activities with all classrooms on a rotational schedule.

Science Programs in Elementary Math/Science Magnet Schools

There are currently no middle school magnets with sixth grades in the district focusing on science. Of the 32 elementary magnet schools, six focus on various aspects of science. According to the principal interviews, science programs at magnets differ from those at other schools in ways involving structure and funding.

1. Magnet schools have special lab rooms for science instruction. These labs are often well-equipped, featuring the latest technology and scientific apparatus.

2. Magnet schools have some teachers who specialize in science instruction.

3. More time is allotted to science in magnet schools. Students receive instruction in the classroom which is later extended by their lab experiences.

A short description of each K-6 magnet school emphasizing science follows:

The Academy for Space Exploration and Technology at Johnson Elementary integrates a strong academic program with the concepts of space exploration and technology. Students receive instruction in space science in their classrooms and by attending in-depth sessions in the Space Center. The school has integrated language arts with space science, particularly in the area of children's literature. Last year, students at the school enjoyed a NASA-sponsored assembly. Johnson is also involved with the Challenger Center sponsored by the Fleet Space Theater.

The Center for Marine Science at Emerson Elementary has adopted an elementary marine science curriculum developed by Project Ocean. Students receive hands-on experiences in marine science exploration and experimentation through the marine science lab on campus and related field experiences in the community. The program content is divided into three main areas: physical science, biological science, and human interactions with the marine environment. Physical science components include water movement, abiotic factors, coastal and marine geology, and seasons of the sea. In biological science, students study adaptation distribution, ecological relationships, population dynamics, cycles, and succession. The human interaction areas include management, pollution, habitat reduction, environmental problem solving, cultural use values, and care and respect.

Chollas Elementary Math/Science Magnet offers specialized facilities and equipment to motivate students and extend the basic math and science curricula. In addition to a strong classroom program, students receive math and science laboratory experiences from teachers who are specially trained in these subjects. One teacher from this school commented, "A lot of interest and excitement is in the air concerning science on our campus."

Encanto Elementary Math/ Science Program provides a school-within-a-school magnet for students who have a strong interest in science, computers, and math. An on-site environmental pond, science laboratory, and specialized equipment are used to motivate student achievement and enrich the instructional program. Energy Week at Encanto encouraged upper grade students to adopt a younger student to teach them about different forms of energy. They made solar cookers, wired electrical circuits, talked through paper telephones, experimented with chemistry, and tested heat insulation with cartons and cotton.

Grant Elementary Math/Science Magnet utilizes special facilities and equipment to motivate student achievement and extend the instructional program. Students receive math and science instruction in labs from teachers who are skilled and experienced in teaching these subjects. For example, students last year enjoyed a day of rocket launching as a culmination activity for a rocketry unit. Their study included the laws of physics and how they pertain to the way rockets work.

Webster Elementary Life Science Magnet offers an in-depth study of plant and animal life on land and water. Students are instructed in science in the classroom and in the science lab. Field trips and community educational resources such as the San Diego Zoo, Sea World, and Scripps Institute of Oceanography reinforce science concepts.

Two other schools in the interview sample described special programs with some unique science opportunities for children.

The accelerated learning magnet at Horton Elementary incorporates science as a content area for accelerated learning units. Some teacher teams have developed special units in the science area.

Green Elementary, with an Academics and Athletics focus, also features some unique science instruction. During the extended P.E. time students receive instruction in biology and anatomy as they relate to sports and physical fitness, etc.

In summary:

- Restructuring provides schools with a unique opportunity to reorganize their science programs. About one-fourth of the teachers from restructuring schools indicated changes have been made or were being planned for their science programs.
- Magnet schools with math/science emphases are able to provide enriched science programs due to their well-equipped facilities, specialized teachers, and increased time for science instruction.

CONCLUSIONS AND RECOMMENDATIONS

> The terms and circumstances of human existence can be expected to change radically during the next human life span. Science, mathematics, and technology will be at the center of that change--causing it, shaping it, responding to it. Therefore, they will be essential to the education of today's children for tomorrow's world.
>
> *Science for All Americans*
> American Association for the
> Advancement of Science (1989)

Conclusion

1. Improving K-6 science is part of a national agenda of school reform and will require long, sustained effort and systemic change at all levels.

Recommendation

The Math and Science Office of the Basic Education Department should continue to provide proactive leadership to school sites in order to develop specific goals aligned with the 1990 California Science Framework. Such leadership will assist schools to focus on goals appropriate to their school levels and obtain necessary inservice opportunities.

Conclusion

2. The district program has developed goals congruent with the current state framework (1978). Those goals are embodied in the 1990 California Science Framework. The district's suggested approach to science instruction is also consistent with the approach called for by the new framework.

Recommendations

The recommended amount of hands-on science instruction for elementary classrooms should be specified by Educational Services Division in the next Course of Study, K-12. These suggested standards should meet the 1990 California Science Framework guidelines.

To further align the district K-6 science program with the 1990 California Science Framework, the district's Math and Science Office should continue to encourage the integration of science with other subject areas through training.

Conclusions

3. Science instruction in the district is mostly text-dominated. However, the use of science kit materials is the most frequent supplement to the text, suggesting that teachers are extending text lessons into teacher demonstrations and student activities. Teachers most often use a combination of district, commercial, and teacher-made materials with their classes.

4. Hands-on activities and class discussions were found to be frequently employed as instructional strategies by both teacher survey and classroom observation. However, class discussion, hands- on science activities, and teacher demonstration, decreased from grades K-3 to grades 4-6. The use of the textbook increased steadily from primary to upper grades.

5. San Diego City Schools K-6 teachers have had more college courses in science than the average teacher in the nation. They also feel more qualified to teach science than their counterparts nationally.

Recommendation

School staffs should examine the priority that science currently holds at their sites. They should realign science instruction to give it more depth than breadth, and to use staff talent and resources more efficiently.

Conclusion

6. District science lessons that were observed showed evidence of active engagement of all students and required that students write or otherwise communicate about science. Science lessons appeared weak in only two areas: teacher modeling of the scientific process and relating lessons to real-world experiences.

Recommendation

Site leadership should be responsive to school needs, taking responsibility for scheduling appropriate science inservice training for classroom teachers.

Conclusions

7. Principals, teachers, and parents believe in the importance of science instruction at the elementary level. However, principals and parents have apparently failed to communicate to each other their concerns about the importance of science instruction for the elementary child. In addition, parents have not successfully communicated their beliefs about the importance of science to their own children. If children are to value science, they need to know that principals, teachers, and parents believe it is an essential part of a good education.

8. Positive student attitudes toward science decrease as grade level increases, and there is a corresponding decline in the amount of interesting science materials and stimulating displays found in upper grade classrooms.

Recommendation

Site leadership should assess parental attitudes about the importance of elementary science instruction and provide a variety of opportunities for parents to participate in the science program. In addition, site leadership should communicate their belief in the importance of science to parents and students. Pupil progress reports should include a science grade for each reporting period in which science is taught.

Increased involvement in science-related cocurricular activities would be a tangible way to value science and should be made available and encouraged by site leadership.

Conclusions

9. Principals and teachers agree effective science instruction may be inhibited by insufficient time for planning and implementing science activities, inadequate materials, and the perception that teacher inservices are not specific to grade level needs and diverse student populations.

Recommendation

School site leadership should encourage teachers to use strategies for science instruction which make efficient use of their time and subject matter expertise. In addition, teachers should be advised of the science program sequence they are scheduled to follow each year. The unmet needs reported by teachers (time, materials, and inservices) should be given high priority by site administrators and staffs.

10. District science personnel provide a variety of inservices and workshops relating to elementary science education. These training opportunities address the district science program, effective instructional strategies in science, and science extension and enrichment activities. While the department is very proactive, it lacks the necessary resources to meet the district's full demand for teacher inservice.

11. Teachers see themselves as more comfortable in teaching science than do their principals.

Conclusion	Recommendation
12. Time spent in science instruction in elementary classrooms generally met district guidelines. However, sixth grade students at middle schools received only about half as much science instruction as did sixth grade students at elementary schools. AGP classrooms were found to average fewer minutes of science instruction per week than non-AGP classrooms.	Each school, with the assistance of the district Math and Science Office, should ensure that all students have access to a high quality science program, including appropriate facilities and adequate instructional time. In particular, the allotment of time for sixth-grade science in middle schools needs to be revised to meet district guidelines.

Conclusions

13. The most frequently used method of assessing pupil progress in science is the publisher's test. However, these traditional tests usually tap the lowest levels of student knowledge.

14. ESPET results demonstrate that, compared to New York State students, San Diego fourth graders scored high in inferential skills, were about evenly matched in observing and predicting, and scored lower in measuring, classifying, manipulating materials, and interpreting data. District results show that girls and boys had very similar total mean scores, but showed differences in individual items. Girls were more successful in observing and predicting, measuring temperature, classifying objects, and interpreting data, and boys had greater success in working with electrical circuits, measuring mass, and making inferences. Among the racial/ethnic groups, Whites had the highest mean scores, followed by Filipino, Asian, African American, Hispanic, and Indochinese students. Students in math/science magnets had a higher mean score than students in non-math/science magnet schools; students in AGP schools scored lower than non-AGP schools; and restructuring schools scored slightly higher than non-restructuring schools.

Recommendation

The district's Math and Science Office should continue its proactive approach to teacher inservice training, emphasizing hands-on science activities and alternative assessment techniques. The Evaluation Department should provide technical assistance in the area alternative assessment. Student assessment will include observation of student lab activities, performance-based testing, and portfolios of student work across units of study.

RE: L.1

San Diego City Schools
PLANNING, RESEARCH, AND EVALUATION DIVISION

EVALUATION OF THE K-6 SCIENCE PROGRAM

APPENDICES

No.
654A

NOVEMBER 13, 1990

EVALUATION DEPARTMENT REPORT

BEST COPY AVAILABLE

APPENDIX A

CLASSROM TEACHER SURVEY
METHODOLOGY, SURVEY INSTRUMENT, AND RESPONSES

EVALUATION OF THE K-6 SCIENCE PROGRAM
Classroom Teacher Survey

During the course of the K-6 Science Evaluation, an effort was made to follow the suggestions and advice of the project advisory committee and the district Science Office. The evaluation design called for the use of surveys to gather information regarding teacher attitudes toward elementary science, instructional practices, professional growth, and program strengths and needs.

SURVEY METHODOLOGY

Since every elementary teacher is involved in science instruction, it was decided to send a teacher survey to a randomly selected sample of district elementary classroom teachers. The sample consisted of every third classroom teacher from an alpha list of district elementary teachers. In addition, a survey was sent to all middle school teachers who were responsible for science instruction for sixth grade students.

The district Science Office and the Evaluation Department collaborated in the development of a survey instrument that would answer questions posed both by the evaluation design and district science personnel. In order to gather as much information as possible using a reasonable number of items, two forms of the survey (Form A and Form B) were developed. One half of the teachers surveyed received Form A of the survey and one half received Form B. The K-6 Science Advisory Committee reviewed and approved the survey before its administration.

A total of 888 surveys were sent to teachers via school mail on February 15, 1990. Teachers were asked to record their responses on a general purpose scan sheet and to return the answer sheets in the pre-addressed envelope provided by February 28, 1990. Of the 888 survey forms mailed, 494 (56 percent) were returned. Answer sheets were electronically scanned by the Information Services Bureau (ISB), and data were returned to the Evaluation Department for analysis. Teacher responses to open ended questions were recorded and tabulated.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) to determine response frequencies for each survey item. Selected items were crosstabulated to identify significant differences in the response patterns of various demographic groupings such as grade level, class type, gender, and ethnicity.

A copy of the classroom teacher survey and responses to each item follow.

SAN DIEGO CITY SCHOOLS
Planning, Research, and Evaluation Division
Evaluation Department

K-6 SCIENCE CLASSROOM TEACHER SURVEY

DIRECTIONS FOR COMPLETING CLASSROOM TEACHER SURVEY

1. Do not put your name on this survey nor on the answer sheet.

2. Each school in the district has a three-digit location code. In that section of the green and white answer sheet labeled "IDENTIFICATION," enter in the **first three blocks** the three numbers that identify your school. Using your number 2 pencil, darken the circles containing the numbers directly below the numbers you entered.

3. In the **fourth and fifth blocks** in the area labeled "IDENTIFICATION," enter the numbers from below which identify the grade(s) which you teach. Please darken the circles containing the numbers directly below the numbers you entered.

    00 = Kindergarten
    01 = Grade 1
    02 = Grade 2
    03 = Grade 3
    04 = Grade 4
    05 = Grade 5
    06 = Grade 6 Elementary School
    07 = Grade 6 Middle School
    08 = K-1 Combination
    09 = 1-2 Combination
    10 = 2-3 Combination
    11 = 3-4 Combination
    12 = 4-5 Combination
    13 = 5-6 Combination
    14 = Primary Multi-grade (K-3)
    15 = Upper Multi-grade (4-6)
    16 = K-6 Multi-grade class

4. In the **sixth block** in the area labeled "IDENTIFICATION," enter the number from below which identifies the type of class you teach. Please darken the circle containing the number directly below the number you entered.

    1 = Regular
    2 = Bilingual
    3 = Sheltered
    4 = GATE
    5 = Bilingual GATE
    6 = Special Education
    7 = Other

5. In the **seventh and eighth blocks** in the area labeled "IDENTIFICATION," enter the number of years that you have been teaching. Please enter years as two-digit numbers (Four years = 04). Darken the corresponding circles below the numbers you entered.

6. In the **ninth block** in the area labeled "IDENTIFICATION," enter the number that corresponds to your gender. Darken the corresponding circle below the number you entered.

   1 = Male
   2 = Female

7. In the **tenth block** in the area labeled "IDENTIFICATION," enter the number from below which best describes your racial/ethnic background. Darken the corresponding circle below the number you entered.

   0 = Hispanic
   1 = White
   2 = African American
   3 = Asian
   4 = American Indian/ Alaskan Native
   5 = Pacific Islander
   6 = Portuguese
   7 = Filipino
   8 = Indochinese

8. In the **eleventh, twelfth, and thirteenth blocks** in the area labeled "IDENTIFICATION," enter the approximate number of minutes per week of science instruction that your students receive. Please enter minutes as a three digit number. (For example:, 30 minutes = 030 and 150 minutes = 150.) Please darken the circles directly below the numbers that you entered. For **middle school teachers,** please indicate the amount of time per week that one class would receive.

9. In the **fourteenth block** in the area labeled "IDENTIFICATION," enter the number from below which best describes your answer to the following question. Please darken the circle directly below the number you entered.

   In your teacher preparation courses, did you ever have a course in teaching elementary science?

   1 = Yes
   2 = No
   3 = Don't remember

10. In the **fifteenth block** in the area labeled "IDENTIFICATION," enter the number from below which best describes your answer to the following question. Please darken the circle directly below the number you entered.

    In your college coursework, how many science courses did you take (biology, chemistry, physical science, etc.)?

    0 = None
    1 = One
    2 = Two
    3 = Three
    4 = More than three
    5 = Don't remember

11. Use the blank spaces on the front and back of the answer sheet to make any comments. If the comment refers to a particular question, please make sure that the number of the question is next to the comment.

12. When you have completed the survey, please place your answer sheet in the small envelope provided, and return this survey form and the envelope to your school secretary. He/she will check your name as having completed the survey.

Thank you for your time and attention to this task. Your answers will be of great assistance in the K-6 Science Evaluation.

K-6 SCIENCE EVALUATION SURVEY
Classroom Teacher Survey
Form A

Please indicate the degree to which you agree or disagree with the statements listed below by darkening the circle on the green and white answer sheet which corresponds to your answer.

I. Attitudes About Science

Please use the following rating scale when responding to questions 1 through 8 below.

1	2	3	4	5
Strongly Disagree	**Disagree**	**No Opinion**	**Agree**	**Strongly Agree**

1. Science is an important subject all for K-6 students.
2. I think that science is a difficult subject for all students to master.
3. I consider myself prepared to teach science in my classroom.
4. I am comfortable when teaching science.
5. I enjoy teaching science.
6. My teacher preparation classes prepared me to teach science.
7. I do not have adequate time to prepare/plan for science instruction.
8. There is enough time in the instructional day to effectively teach the district science program.

Please use the following rating scale when responding to questions 9 through 19 below.

1	**2**	**3**	**4**
Not at all	**Somewhat**	**Very Well**	**Did Not Attend**

II. Inservice Opportunities

If you have attended any of the following district-sponsored science inservices, how well did they meet your needs?

9. ____ District inservice for text adoption
10. ____ Publisher inservice for text adoption
11. ____ Follow-up inservice for text adoption
12. ____ Science inservice on selected topic
    (If yes, use white space to indicate topics.)
13. ____ New Teacher Retention workshop

Overall, how well did these district inservices meet your needs as a science teacher?

14. ____ Overall needs in science instruction
15. ____ Needs regarding use of specific text
16. ____ Needs regarding comfort in teaching science
17. ____ Needs regarding instructional strategies
18. ____ Ideas for student projects
19. ____ Other (Please specify in white space on answer sheet.)

20. When would you prefer science inservices to be scheduled?

    1 = After school
    2 = Minimum day
    3 = Professional growth day
    4 = Saturday workshop
    5 = Summer/Off-track workshop

21. What would be most important to you in selecting a science inservice activity?

    1 = College/district credit
    2 = Proximity of class to home/site
    3 = Time of class
    4 = Payment for attendance
    5 = Topic

Please answer yes (1) or no (2) to questions 22 through 30 below.

What other professional development opportunities have helped you stay current in science in the last two years?

22. ____ Discover classes (district-sponsored)
23. ____ University classes
24. ____ Conferences
25. ____ Workshops through community resources (Museums, Sea World, etc.)
26. ____ Professional reading
27. ____ Commercial workshops
28. ____ Membership in professional organizations
29. ____ County Office sponsored inservices
30. ____ Mentor teacher demonstrations

III. Curriculum and Instruction

31. Do you follow the district sequence guidelines for teaching science (Sequence A and Sequence B)?

1 = Yes
2 = Sometimes
3 = No
4 = Not sure

32. If you teach a multi-grade class, which level of curriculum materials do you use?

1 = Lower grade
2 = Higher grade
3 = Both grades
4 = Not applicable

Rate the following using the range scale below:

1	2	3	4	5
Poor Quality		Average Quality		Superior Quality

33. ____ Overall district science program
34. ____ District Science Curriculum Guide
35. ____ Student text
36. ____ Silver Burdett Teacher's Manual
37. ____ Silver Burdett worksheets
38. ____ Silver Burdett tests
39. ____ Silver Burdett filmstrips
40. ____ Silver Burdett science kits and manipulatives

41. Which of the following best describes the kinds of science materials that you use in your classroom?

1 = District curriculum and materials only
2 = District curriculum and materials, but supplement with commercial materials
3 = District curriculum and materials, but supplement with teacher-made materials
4 = District curriculum and materials, but supplement with both commercial and teacher-made materials
5 = Only commercial and/or teacher-made materials

Please use the following rating scale when answering questions 42 through 55 below.

1	**2**	**3**	**4**	**5**
Never	**Infrequently**	**Occasionally**	**Frequently**	**Extensively**

How often do you use the following to teach science in your classroom?

42. ____ Silver Burdett science kit
43. ____ IMC books/science trade books
44. ____ IMC exhibits
45. ____ Audiovisual materials (soundstrips, films, videos)
46. ____ Computer software

How often do you use the following to augment the science program in your classroom?

1	**2**	**3**	**4**	**5**
Never	**Infrequently**	**Occasionally**	**Frequently**	**Extensively**

47. ____ Science-related field trips
48. ____ Science fair/Invention Convention
49. ____ Community speakers
50. ____ Career awareness activities
51. ____ Business partnerships
52. ____ Community service activities
53. ____ Science Lab/Pullout program
54. ____ Science-related assemblies
55. ____ Other technologies (Please specify in white area on answer sheet.)

56. Are students recognized by your school for achievement in science?

1	2	3	4	5
Never	Infrequently	Occasionally	Frequently	Extensively

IV. Equipment, Facilities, and Supplies

57. Are building facilities at your site adequate to teach the district science program effectively?

1	2	3	4	5
Not at all	Somewhat Adequate	Adequate	More than Adequate	Excellent

58. Is operational audio-visual equipment available for your use when teaching science?

1	2	3	4	5
Never	Occasionally	Usually	Most of the time	Always

59. Are the instructional supplies needed to teach the district science program available at your site?

1	2	3	4	5
Never	Occasionally	Usually	Most of the time	Always

60. When a science activity requires materials not available at the school site, do you most often:

1 = Purchase yourself **with** reimbursement from site
2 = Purchase yourself **without** reimbursement from site
3 = Order through custodian
4 = Have students/parents supply materials
5 = Skip the activity

V. Methods of Assessment

Which of the following methods do you use to assess student progress in science?

Please use the following rating scale when responding to questions 61 through 68.

1	**2**	**3**
Never	**Sometimes**	**Regularly**

61. ____ Publisher's test without essay
62. ____ Publisher's test with essay
63. ____ Teacher developed test without essay
64. ____ Teacher developed test with essay
65. ____ Activity/Lab assessment
66. ____ Science projects
67. ____ Science homework
68. ____ Student portfolios

VI. Individual Site Programs

69. If your school is restructuring, are you planning/implementing any changes that will affect your science program? (If yes, please specify in white space on answer sheet.)

1 = yes
2 = no
3 = Not a restructuring school

70. Is there anything that you would consider to be unique or innovative about the science program at your site? (If yes, please specify in white space on answer sheet.)

1 = yes
2 = no

Middle school teachers, please answer question 71.

71. How do sixth grade students receive science instruction at your site?

1 = As a separate single subject taught by teacher outside sixth grade core
2 = As part of an exploratory/elective "wheel"
3 = As part of the sixth grade home teacher's curriculum
4 = Not taught

Elementary school teachers, please answer questions 72 and 73.

72. How is science instruction scheduled in your classroom?

1 = Taught by you as a separate subject on a daily basis
2 = Taught by you as a separate subject using block scheduling
3 = Taught by you integrated with other curriculum areas
4 = Taught by another teacher
5 = Not taught

73. When time constraints make it impossible for you to complete all subjects in your daily plan, which subject are you most likely to skip?

1 = Social Studies
2 = Science
3 = Physical Education
4 = Fine Arts
5 = Handwriting

VII. Open-Ended Questions

74. What would be your **one** recommendation on how best to improve science instruction in the district? (Please use white space on answer sheet to respond.)

75. What are staff goals for science at your site? (Use white space on answer sheet for your response.)

76. Please list any needs relating to your science program that have not been met. (Use white space on answer sheet to respond.)

Thank you for the time and thought that you have given to this survey. Please use the envelope provided to return your completed answer to your school secretary.

K-6 SCIENCE EVALUATION SURVEY
Classroom Teacher Survey
Form B

Please indicate the degree to which you agree or disagree with the statements listed below by darkening the circle on the green and white answer sheet which corresponds to your answer.

I. Attitudes About Science

Please use the following rating scale when responding to questions 1 through 8 below.

1	2	3	4	5
Strongly Disagree	**Disagree**	**No Opinion**	**Agree**	**Strongly Agree**

1. Science is an important subject all for K-6 students.

2. I think that science is a difficult subject for all students to master.

3. I consider myself prepared to teach science in my classroom.

4. I am comfortable when teaching science.

5. I enjoy teaching science.

6. My teacher preparation classes prepared me to teach science.

7. I do not have adequate time to prepare/plan for science instruction.

8. There is enough time in the instructional day to effectively teach the district science program.

Please use the following rating scale when responding to questions 9 through 19 below.

1	2	3	4
Not at all	**Somewhat**	**Very Well**	**Did Not Attend**

II. Inservice Opportunities

If you have attended any of the following district-sponsored science inservices, how well did they meet your needs?

9. ____ District inservice for text adoption
10. ____ Publisher inservice for text adoption
11. ____ Follow-up inservice for text adoption
12. ____ Science inservice on selected topic
(If yes, use white space to indicate topics.)
13. ____ New Teacher Retention workshop

Overall, how well did these district inservices meet your needs as a science teacher?

14. ____ Overall needs in science instruction
15. ____ Needs regarding use of specific text
16. ____ Needs regarding comfort in teaching science
17. ____ Needs regarding instructional strategies
18. ____ Ideas for student projects
19. ____ Other (Please specify in white space on answer sheet.)

20. When would you prefer science inservices to be scheduled?

1 = After school
2 = Minimum day
3 = Professional growth day
4 = Saturday workshop
5 = Summer/Off-track workshop

21. What would be most important to you in selecting a science inservice activity?

1 = College/district credit
2 = Proximity of class to home/site
3 = Time of class
4 = Payment for attendance
5 = Topic

Please answer yes (1) or no (2) to questions 22 through 30 below.

What other professional development opportunities have helped you stay current in science in the last two years?

22. ____ Discover classes (district-sponsored)
23. ____ University classes
24. ____ Conferences
25. ____ Workshops through community resources (Museums, Sea World, etc.)
26. ____ Professional reading
27. ____ Commercial workshops
28. ____ Membership in professional organizations
29. ____ County Office sponsored inservices
30. ____ Mentor teacher demonstrations

III. Curriculum and Instruction

31. Do you follow the district sequence guidelines for teaching science (Sequence A and Sequence B)?

1 = Yes
2 = Sometimes
3 = No
4 = Not sure

32. If you teach a multi-grade class, which level of curriculum materials do you use?

1 = Lower grade
2 = Higher grade
3 = Both grades
4 = Not applicable

Rate the following using the range scale below:

1	2	3	4	5
Poor Quality		**Average Quality**		**Superior Quality**

33. ____ Overall district science program
34. ____ District Science Curriculum Guide
35. ____ Student text
36. ____ Silver Burdett Teacher's Manual
37. ____ Silver Burdett worksheets
38. ____ Silver Burdett tests
39. ____ Silver Burdett filmstrips
40. ____ Silver Burdett science kits and manipulatives

41. Which of the following best describes the kinds of science materials that you use in your classroom?

1 = District curriculum and materials only
2 = District curriculum and materials, but supplement with commercial materials
3 = District curriculum and materials, but supplement with teacher-made materials
4 = District curriculum and materials, but supplement with both commercial and teacher-made materials
5 = Only commercial and/or teacher-made materials

Please use the following rating scale when answering questions 42 through 55 below.

1	**2**	**3**	**4**	**5**
Never	**Infrequently**	**Occasionally**	**Frequently**	**Extensively**

How often do you use the following strategies when teaching science?

42. ____ Whole class instruction using texts
43. ____ Cooperative learning
44. ____ Science experiments/activities (teacher demonstration)
45. ____ Science experiments/activities (total student participation)
46.____ Class discussion
47.____ Science projects
48.____ Science homework
49.____ Team teaching
50.____ Switch teaching
51.____ Block scheduling
52.____ Science across the curriculum
53.____ Students working with the scientific community
54.____ Cross-age tutoring
55.____ Peer tutoring

56. Are students recognized by your school for achievement in science?

1	2	3	4	5
Never	Infrequently	Occasionally	Frequently	Extensively

IV. Equipment, Facilities, and Supplies

57. Are building facilities at your site adequate to teach the district science program effectively?

1	2	3	4	5
Not at all	Somewhat Adequate	Adequate	More than Adequate	Excellent

58. Is operational audio-visual equipment available for your use when teaching science?

1	2	3	4	5
Never	Occasionally	Usually	Most of the time	Always

59. Are the instructional supplies needed to teach the district science program available at your site?

1	2	3	4	5
Never	Occasionally	Usually	Most of the time	Always

60. When a science activity requires materials not available at the school site, do you most often:

1 = Purchase yourself **with** reimbursement from site
2 = Purchase yourself **without** reimbursement from site
3 = Order through custodian
4 = Have students/parents supply materials
5 = Skip the activity

V. Needs for Resources

Please use the following scale to answer questions 61 through 68 below.

1	2	3	4
Not at all helpful	**Somewhat helpful**	**Very helpful**	**Not sure**

In terms of your own needs as a science teacher, how helpful would each of the following district services/resources be?

61. ____ Site-specific district science inservices
62. ____ Science demonstration lessons
63. ____ Mentor assistance
64. ____ Science across the curriculum inservice
65. ____ Teaching strategies inservices (cooperative learning, critical thinking, etc.)
66. ____ Opportunities to attend conferences
67. ____ Resource Teacher assistance
68. ____ Current media (films, videos, etc.)

69. If your school is restructuring, are you planning/implementing any changes that will affect your science program? (If yes, please specify in white space on answer sheet.)

1 = yes
2 = no
3 = Not a restructuring school

70. Is there anything that you would consider to be unique or innovative about the science program at your site? (If yes, please specify in white space on answer sheet.)

1 = yes
2 = no

Middle school teachers, please answer question 71.

71. How do sixth grade students receive science instruction at your site?

1 = As a separate single subject taught by teacher outside sixth grade core
2 = As part of an exploratory/elective "wheel"
3 = As part of the sixth grade home teacher's curriculum
4 = Not taught

Elementary school teachers, please answer questions 72 and 73.

72. How is science instruction scheduled in your classroom?

1 = Taught by you as a separate subject on a daily basis
2 = Taught by you as a separate subject using block scheduling
3 = Taught by you integrated with other curriculum areas
4 = Taught by another teacher
5 = Not taught

73. When time constraints make it impossible for you to complete all subjects in your daily plan, which subject are you most likely to skip?

1 = Social Studies
2 = Science
3 = Physical Education
4 = Fine Arts
5 = Handwriting

V. Open-Ended Questions

74. What would be your **one** recommendation of how best to improve science instruction in the district? (Please use white space on answer sheet to respond.)

75. What are staff goals for science at your site? (Use white space on answer sheet for your response.)

76. Please list any needs relating to your science program that have not been met. (Use white space on answer sheet to respond.)

Thank you for the time and thought that you have given to this survey. Please use the envelope provided to return your completed answer sheet to your school secretary.

RESULTS FROM THE 1989-1990 K-6 SCIENCE EVALUATION

TEACHER SURVEY

GENERAL INFORMATION ON RESPONDENTS

Total Number	N=494		Number	Percent
Male	N=73	Hispanic	54	11.6%
Female	N=400	White	346	74.6%
		African American	40	8.6%
Kindergarten	N=60	Asian	11	2.4%
Primary	N=161	American Indian	3	0.6%
Upper	N=247	Portugese	4	0.9%
		Filipino	6	1.3%
Regular	N=322	Not Indicated	30	6.1%
Bilingual	N=39			
GATE	N=57			
Special Ed.	N=24			

Mean number of minutes of science taught per week:

All	115.03
Kindergarten	86.46
Primary	107.33
Upper	125.22
Male	126.66
Female	112.39

Question 1:	Science is an important subject for all K-6 students.		
	Disagree	No Opinion	Agree
All	**5.3**	**1.0**	**93.6**
Male	4.1	1.4	94.5
Female	4.6	1.0	94.4
Kindergarten	5.0	0.0	95.0
Primary	5.0	1.9	93.1
Upper	5.7	0.8	93.5
Regular	6.5	1.6	91.9
Bilingual	2.6	0.0	97.4
GATE	3.5	0.0	96.5
Special Ed.	0.0	0.0	100.0
Question 2:	I think that science is a difficult subject for all students to master.		
	Disagree	No Opinion	Agree
All	**75.1**	**6.1**	**18.8**
Male	72.6	9.6	17.8
Female	76.1	5.3	18.7
Kindergarten	80.0	8.3	11.7
Primary	80.7	3.7	15.5
Upper	71.2	6.5	22.2
Regular	76.1	5.9	18.1
Bilingual	84.6	5.1	10.3
GATE	68.4	7.0	24.6
Special Ed.	58.4	4.2	37.5

Question 3:	I consider myself prepared to teach science in my classroom.		
	Disagree	**No Opinion**	**Agree**
All	**16.0**	**6.5**	**77.6**
Male	12.3	4.1	83.6
Female	16.4	7.1	76.5
Kindergarten	11.7	6.7	81.6
Primary	13.6	3.7	82.7
Upper	17.9	8.1	74.0
Regular	15.2	5.6	79.1
Bilingual	17.9	0.0	66.7
GATE	12.5	7.1	80.4
Special Ed.	33.3	4.2	62.5

Question 4:	I am comfortable when teaching science.		
	Disagree	No Opinion	Agree
All	**14.9**	**5.7**	**79.4**
Male	10.9	5.5	83.6
Female	15.4	5.5	79.1
Kindergarten	13.3	1.7	85.0
Primary	9.3	5.6	85.1
Upper	18.3	6.9	74.9
Regular	14.3	5.3	80.4
Bilingual	15.4	7.7	76.9
GATE	14.0	5.3	80.7
Special Ed.	25.0	4.2	70.8

Question 5:	**I enjoy teaching science.**		
	Disagree	**No Opinion**	**Agree**
All	**12.6**	**8.7**	**78.7**
Male	9.5	8.2	82.2
Female	12.8	8.8	78.3
Kindergarten	16.7	8.3	75.0
Primary	8.7	6.2	85.2
Upper	13.4	10.9	75.7
Regular	13.0	9.3	77.6
Bilingual	7.7	10.3	82.1
GATE	10.5	7.0	82.5
Special Ed.	16.7	0.0	83.3
Question 6:	**My teacher preparation classes prepared me to teach science.**		
	Disagree	**No Opinion**	**Agree**
All	**47.7**	**14.7**	**37.6**
Male	47.9	17.8	34.2
Female	48.2	14.1	37.6
Kindergarten	46.7	13.3	40.0
Primary	41.9	14.4	43.8
Upper	52.6	15.8	31.6
Regular	45.9	15.0	39.0
Bilingual	51.3	15.4	33.3
GATE	47.4	17.5	35.1
Special Ed.	62.5	12.5	25.0

Question 7:	I do not have adequate time to prepare/plan for science instruction.		
	Disagree	**No Opinion**	**Agree**
All	**21.2**	**5.5**	**73.3**
Male	20.5	6.8	72.6
Female	20.9	4.8	74.3
Kindergarten	26.7	5.0	68.3
Primary	20.5	5.6	73.9
Upper	20.3	5.3	74.5
Regular	20.9	4.4	74.8
Bilingual	23.0	7.7	69.2
GATE	19.3	1.8	78.9
Special Ed.	16.7	0.0	83.3

Question 8:	There is enough time in the instructional day to effectively teach the district science program.		
	Disagree	**No Opinion**	**Agree**
All	**57.7**	**6.1**	**36.2**
Male	53.4	4.1	42.4
Female	59.0	6.0	34.9
Kindergarten	55.0	5.0	40.0
Primary	57.4	4.9	37.7
Upper	59.1	7.3	33.6
Regular	58.7	6.2	35.1
Bilingual	61.6	5.1	33.4
GATE	52.6	5.3	42.1
Special Ed.	54.2	12.5	33.4

Question 9:	How well did district inservice for text adoption meet your needs?			
	Not at all	Somewhat	Very well	Did not attend
All	2.7	26.5	13.9	54.7
Question 10:	How well did publisher inservice for text adoption meet your needs?			
	Not at all	Somewhat	Very well	Did not attend
All	2.8	16.0	7.0	70.5
Question 11:	How well did district follow-up inservice for text adoption meet your needs?			
	Not at all	Somewhat	Very well	Did not attend
All	3.2	14.8	8.1	69.8
Question 12:	How well did district science inservce on selected topics meet your needs?			
	Not at all	Somewhat	Very well	Did not attend
All	5.7	12.5	12.0	65.8
Question 13:	How well did the district New Teacher Retention Workshop meet your needs?			
	Not at all	Somewhat	Very well	Did not attend
All	4.7	8.8	2.8	77.3
Question 14:	Overall, how well did these district inservices meet your needs?			
	Not at all	Somewhat	Very well	Did not attend
All	7.5	43.5	13.8	33.9

Question 15:	How well did these district inservices meet your needs regarding use of a specific text?			
	Not at all	Somewhat	Very well	Did not attend
All	12.9	33.1	17.4	35.0
Question 16:	How well did these district inservices meet your needs regarding comfort in teaching science?			
	Not at all	Somewhat	Very well	Did not attend
All	15.0	33.8	15.5	34.3
Question 17:	How well did these district inservices meet your needs regarding instructional strategies?			
	Not at all	Somewhat	Very well	Did not attend
All	13.2	36.2	14.4	34.3
Question 18:	How well did these district inservices meet your needs regarding ideas for student projects?			
	Not at all	Somewhat	Very well	Did not attend
All	18.3	31.1	15.9	33.0
Question 20:	When would you prefer science inservices to be scheduled?			
After School	Minimum Day	Professional Growth Day	Saturday Workshop	Summer/ Off-Track
4.2	29.9	50.1	6.5	9.3
Question 21:	What would be most important to you in selecting a science inservice activity?			
College/ District Credit	Proximity to home/site	Time of Class	Payment for Attendance	Topic
9.7	15.7	23.5	14.8	36.2

Questions 22-30	What other professional development opportunities have helped you stay current in science?		
		Yes	No
Discover Classes		16.6	82.3
University Classes		23.7	75.4
Conferences		33.8	65.2
Community Workshops		48.5	50.6
Professional Reading		65.6	33.8
Commercial Workshops		10.7	88.2
Professional Organizations		19.5	80.1
County Office Inservices		9.2	90.1
Mentor Teacher Demonstrations		27.6	71.5
Question 31:	Do you follow the district sequence guidelines for teaching science?		
Yes	Sometimes	No	Not sure
55.5	31.9	10.1	2.5
Question 32:	If you teach a multi-grade class, which level of science materials do you use?		
Lower Grade	Higher Grade	Both Grades	Not Applicable
13.3	23.7	6.1	56.4

Questions 33-40	Please rate the following using the range scale below.			
		Below Average	Average Quality	Above Average
Overall Science Program		14.0	55.0	31.0
District Curriculum Guide		21.0	53.3	25.7
Student Text		17.4	50.4	32.2
Silver Burdett Teacher's Manual		12.6	49.5	37.9
Silver Burdett Worksheets		24.4	50.7	24.9
Silver Burdett Tests		27.1	51.1	21.8
Silver Burdett Filmstrips		13.7	46.2	40.1
Silver Burdette Science Kits and Manipulatives		10.1	36.1	53.9

Question 41:	Which of the following best describes the kinds of science materials that you use in your classroom?				
	District Only	District and Commerical	District and Teacher-Made	District/Teacher/ Commerical	Teacher/ Commerical
All	**11.4**	**10.2**	**12.5**	**64.0**	**1.9**
Kindergarten	8.3	3.3	10.1	75.0	1.7
Primary	7.0	9.5	10.1	72.8	0.6
Upper	15.3	12.0	14.5	55.8	2.5
Regular	13.6	10.7	11.7	63.1	0.9
Bilingual	7.9	5.3	15.8	71.1	0.0
GATE	1.8	12.7	14.5	67.3	3.6
Special Ed.	12.5	4.2	12.5	66.7	4.2

Questions 42-55 Form A	How often do you use the following to teach/augment the science program in your classroom?		
	Never/ Infrequently	Occasionally	Frequently/ Extensively
Silver Burdett Science Kit	19.6	37.0	43.4
IMC Books/Science Trade Books	44.9	30.1	25.0
IMC Exhibits	69.5	22.0	8.5
AV materials	26.7	33.9	39.4
Computer Software	82.2	10.6	7.2
Science-Related Field Trips	52.5	33.5	13.9
Science Fair/Invention Convention	70.9	17.5	11.5
Community Speakers	73.3	20.8	5.9
Career Awareness Activities	68.1	22.1	9.8
Business Partnerships	84.6	11.1	4.3
Community Service Activities	85.1	11.4	3.4
Science Lab/Pullout Program	87.3	1.7	11.0
Science-Related Assemblies	75.8	23.4	0.8

Questions	How often do you use the following strategies when teaching science?		
42-55			
Form B	Never/ Infrequently	Occasionally	Frequently/ Extensively
Whole Class Instruction Using Text	14.3	13.5	72.1
Cooperative Learning	13.4	39.2	47.3
Experiments/Activities (Teacher Demonstration)	19.1	45.3	35.5
Experiments/Activities (Total Student Participation)	18.1	37.9	44.1
Class Discussion	2.9	9.8	87.3
Science Projects	42.8	33.7	23.4
Science Homework	42.7	36.2	20.9
Team Teaching	85.2	5.7	9.0
Switch Teaching	87.1	5.0	7.9
Block Scheduling	62.1	16.0	21.9
Science Across the Curriculum	36.4	34.7	28.9
Students Working With Scientific Community	91.7	4.5	3.7
Cross-Age Tutoring	83.5	9.1	7.4
Peer Tutoring	59.3	21.2	19.5

Question 56:	Are students recognized by your school for achievement in science?		
	Never/ Infrequently	Occasionally	Frequently/ Extensively
All	60.5	24.4	15.2
Kindergarten	58.6	24.1	17.2
Primary	63.7	22.3	14.0
Upper	61.7	25.0	13.4

Question 57:	Are building facilities at your site adequate to teach the district science program?			
Not at all	Somewhat Adequate	Adequate	More than Adequate	Excellent
18.0	29.7	41.6	7.1	3.6
Question 58:	Is operational audio-visual equipment available for your use when teaching science?			
Never	Occasionally	Usually	Most of the time	Always
2.3	18.2	24.9	30.1	24.5
Question 59:	Are the instructional supplies needed to teach the district science program available at your site?			
Never	Occasionally	Usually	Most of the time	Always
1.7	18.1	31.0	33.1	16.0

Question 60:	When a science activity requires materials not available at the school site, do you most often:				
	Purchase With Reimbursement	Purchase Without Reimbursement	Order Through Custodian	Parents/Students Supply Materials	Skip Activity
All	2.6	70.1	4.6	5.3	17.4
Kindergarten	0.0	78.9	1.8	1.8	17.5
Primary	1.3	80.1	3.8	3.2	11.5
Upper	3.5	61.9	6.1	7.8	20.8
Regular	2.0	69.4	4.6	5.5	18.6
Bilingual	0.0	76.3	5.3	2.6	15.8
GATE	3.8	71.2	7.7	3.8	13.5
Special Ed.	8.3	62.5	4.2	4.2	20.8
Male	5.6	56.9	9.7	6.9	20.8
Female	2.1	72.5	3.7	5.1	16.6

Questions 61-68 Form A	Which of the following methods do you use to assess student progress in science?			
		Never	Sometimes	Regularly
Publisher's test without essay		32.8	36.6	30.6
Publisher's test with essay		57.2	27.1	14.8
Teacher developed test without essay		43.0	40.9	15.7
Teacher developed test with essay		67.0	25.6	6.6
Activity/Lab assessment		37.6	39.7	22.3
Science projects		25.0	48.7	25.4
Science homework		22.4	56.1	20.6
Student portfolios		55.5	26.4	17.2

Questions 61-68 Form B	How helpful would each of the following district services/ resources be to you as a science teacher?				
		Not at all Helpful	Somewhat Helpful	Very Helpful	Not Sure
Site-Specific District Science Inservices		9.1	28.8	55.6	6.6
Science Demonstration Lessons		4.1	18.2	73.1	4.5
Mentor Assistance		14.0	26.9	48.3	10.7
Science Across the Curriculum Inservice		10.8	27.5	53.8	7.5
Teaching Stratetles Inservice		10.4	35.3	48.1	6.2
Opportunities to Attend Conferences		8.8	19.6	65.4	5.8
Resource Teacher Assistance		14.2	27.5	52.5	5.8
Current Media		3.8	18.8	70.8	5.0

Question 69:	If your school is restructuring, are you planning/ implementing any changes that will affect your science program?		
	Yes	14.0	
	No	41.0	
	Not Restructuring	44.6	
Question 70:	Is there anything that you would consider to be unique or innovative about the science program at your site?		
	Yes	20.6	
	No	79.4	
Question 71:	Middle school teachers: How do sixth grade students receive science instruction at your site?		
	Separate Single Subject		15.6
	Exploratory "Wheel"		7.3
	Part of Homeroom Teacher's Program		52.3
	Not Taught		23.9
Question 72:	Elementary school teachers: How is science instruction scheduled in your classroom?		
Taught by you as separate subject daily			40.3
Taught by you as separate subject in block scheduling			33.2
Taught by you integrated with other subject areas			23.2
Taught by another teacher			3.1
Not Taught			0.2
Question 73:	When time constraints make it impossible for you to complete all subjects in your daily plan, which subject are you most likely to skip?		
	Social Studies	11.5	
	Science	8.5	
	Physical Education	25.8	
	Fine Arts	25.3	
	Handwriting	29.0	

Question 69:	If your school is restructuring, are you planning/ implementing any changes that will affect your science program?		
	Yes	14.0	
	No	41.0	
	Not Restructuring	44.6	
Question 70:	Is there anything that you would consider to be unique or innovative about the science program at your site?		
	Yes	20.6	
	No	79.4	
Question 71:	Middle school teachers: How do sixth grade students receive science instruction at your site?		
	Separate Single Subject		15.6
	Exploratory "Wheel"		7.3
	Part of Homeroom Teacher's Program		52.3
	Not Taught		23.9
Question 72:	Elementary school teachers: How is science instruction scheduled in your classroom?		
Taught by you as separate subject daily			40.3
Taught by you as separate subject in block scheduling			33.2
Taught by you integrated with other subject areas			23.2
Taught by another teacher			3.1
Not Taught			0.2
Question 73:	When time constraints make it impossible for you to complete all subjects in your daily plan, which subject are you most likely to skip?		
	Social Studies	11.5	
	Science	8.5	
	Physical Education	25.8	
	Fine Arts	25.3	
	Handwriting	29.0	

APPENDIX B

STUDENT AND PARENT SURVEYS
METHODOLOGY, SURVEY INSTRUMENTS, AND RESPONSES

EVALUATION OF THE K-6 SCIENCE PROGRAM
Student and Parent Surveys

During the course of the K-6 Science Evaluation, an effort was made to follow the suggestions and advice of the project advisory committee and the district Science Office. The evaluation design called for the use of surveys to gather information regarding student attitudes toward science and science instruction. Although a parent survey was not included in the original evaluation design, the Science Evaluation Advisory Committee felt that a survey of parent attitudes toward science and science instruction would be a valuable part of the evaluation process. To determine parent attitudes, the committee requested that a parent survey be used. The committee reviewed and approved both the student and parent surveys before administration.

SURVEY METHODOLOGY

Since all students receive science instruction as a part of the district elementary curriculum, it was decided to administer a student survey to a sample of district K-6 students. In order to minimize the impact of the study on schools across the district, schools chosen to complete student surveys had participated in neither the Elementary Science Program Evaluation Test (ESPET) nor classroom observation. One classroom at each of these schools was selected to participate in the student survey. One third of the classrooms were grade two, one third were grade four, and the remaining one third were grade six. For ease in survey distribution and in an effort to link parent and student responses, parent surveys were given to the parents of students in classrooms participating in the student survey.

Student surveys were distributed on March 28, 1990 and were to be returned via school mail by April 6, 1990. A total of 1047 second, fourth, and sixth grade students completed the student survey. Fourth and sixth grade students recorded their responses on general purpose scan sheets which were electronically scanned by the Information Services Bureau (ISB) and returned to the Evaluation Department for analysis. Since second grade students recorded their responses directly onto the survey form, it was necessary to hand enter their answers using dBase III+. Student data from all grade levels were aggregated before analysis.

Parent surveys were also distributed on March 28, 1990 with a return date of April 6, 1990. A total of 644 parents of second, fourth, and sixth grade students responded to the parent survey. Parents recorded their responses on general purpose scan sheets which were electronically scanned by the Information Services Bureau (ISB) and returned to the Evaluation Department for analysis.

All data were analyzed using the Statistical Package for the Social Sciences (SPSS) to determine response frequencies for each survey item. Selected items were crosstabulated to identify significant differences in the response patterns of various demographic groupings such as grade level, gender, and ethnicity.

Copies of the student and parent surveys and responses follow.

K-6 SCIENCE EVALUATION
STUDENT SURVEY

My name is ____.

Circle the correct choice: I am a boy. I am a girl.

Circle the face which matches how you feel about each sentence.

Sample Item:	Yes	Not Sure	No
I LIKE ICE CREAM.	☺	😐	☹

		Yes	Not Sure	No
1.	I like science.	☺	😐	☹
2.	We have interesting books about science in my classroom.	☺	😐	☹
3.	Boys are better in science than girls.	☺	😐	☹
4.	Girls are better in science than boys.	☺	😐	☹
5.	I like to do science worksheets at school.	☺	😐	☹
6.	I like to do science experiments at school.	☺	😐	☹

TURN THIS PAGE OVER

		Yes	Not Sure	No
7.	Our science textbook is interesting.	☺	😐	☹
8.	I read books about science for fun.	☺	😐	☹
9.	I think science is easy.	☺	😐	☹
10.	I use a computer at school.	☺	😐	☹
11.	Science class is interesting.	☺	😐	☹
12.	I need to do well in science to get a good job when I grow up.	☺	😐	☹
13.	I like to tell my family about what I learn in science.	☺	😐	☹
14.	My family thinks it's important for me to learn science.	☺	😐	☹

Thank you for helping us by completing this survey.

STOP. GIVE THIS SURVEY TO YOUR TEACHER.

K-6 SCIENCE EVALUATION
STUDENT SURVEY

Sample Item:

I LIKE ICE CREAM.

Yes	Not Sure	No
1	2	3
○	○	○

1. I like science.

Yes	Not Sure	No
1	2	3

2. We have interesting books about science in my classroom.

Yes	Not Sure	No
1	2	3

3. Boys are better in science than girls.

Yes	Not Sure	No
1	2	3

4. Girls are better in science than boys.

Yes	Not Sure	No
1	2	3

5. I like to do science worksheets at school.

Yes	Not Sure	No
1	2	3

6. I like to do science experiments at school.

Yes	Not Sure	No
1	2	3

DO NOT STOP, TURN THE PAGE OVER AND KEEP WORKING

7. Our science textbook is interesting.

Yes	Not Sure	No
1	2	3

8. I read books about science for fun.

Yes	Not Sure	No
1	2	3

9. I think science is easy.

Yes	Not Sure	No
1	2	3

10. I use a computer at school.

Yes	Not Sure	No
1	2	3

11. My teacher makes science class interesting.

Yes	Not Sure	No
1	2	3

12. I need to do well in science to get a good job when I grow up.

Yes	Not Sure	No
1	2	3

13. I like to tell my family about what I learn in science.

Yes	Not Sure	No
1	2	3

14. My family thinks it's important for me to learn science.

Yes	Not Sure	No
1	2	3

Thank you for helping us by completing this survey.

STOP. GIVE THIS SURVEY
AND THE GREEN AND WHITE
ANSWER SHEET TO YOUR TEACHER.

K-6 SCIENCE STUDY

Student Survey Results

	GRADE LEVEL	**N=1048**	**%**	
	Grade 2	N=376	36.0%	
	Grade 4	N=340	32.6%	
	Grade 6	N=325	31.2%	
	GENDER			
	Male	N=517	49.8%	
	Female	N=519	50.0%	
	ETHNICITY			
	Hispanic	N=193	19.6%	
	White	N=465	47.2%	
	African Am.	N=128	13.0%	
	Asian	N=34	3.5%	
	Am. Indian	N=8	0.8%	
	Pac. Islander	N=7	0.7%	
	Portugese	N=9	0.9%	
	Filipino	N=86	8.7%	
	Indochinese	N=55	5.6%	
Question 1:	**I like science.**			
		Yes	**Not Sure**	**No**
	ALL	**68.7**	**19.3**	**11.6**
	Grade 2	72.9	18.1	8.0
	Grade 4	69.4	19.1	11.5
	Grade 6	63.1	20.0	16.0
	Male	70.2	16.8	12.6
	Female	67.1	22.0	10.6
	Hispanic	68.2	19.8	11.5
	White	67.7	20.0	12.0
	African Am.	68.0	14.1	16.4
	Asian	73.5	17.6	8.8
	Filipino	76.7	16.3	7.0
	Indochinese	65.5	27.3	7.3

Question 2:	We have interesting books about science in my in my classroom.			
		Yes	Not Sure	No
	ALL	45.8	35.0	18.5
	Grade 2	64.6	26.1	7.4
	Grade 4	49.1	37.6	13.3
	Grade 6	20.6	42.5	36.9
	Male	45.0	34.7	19.8
	Female	46.1	35.5	17.6
	Hispanic	40.4	41.5	17.1
	White	43.8	34.6	21.2
	African Am.	47.7	33.6	16.4
	Asian	41.2	29.4	29.4
	Filipino	67.4	24.4	8.1
	Indochinese	38.2	40.0	21.8
Question 3:	Boys are better in science than girls.			
		Yes	Not Sure	No
	ALL	18.2	34.9	45.9
	Grade 2	25.3	30.1	42.3
	Grade 4	16.2	33.6	50.1
	Grade 6	12.3	41.2	46.5
	Male	33.5	38.6	26.6
	Female	2.9	31.0	65.7
	Hispanic	20.2	38.3	39.4
	White	17.5	29.7	52.2
	African Am.	24.2	32.8	42.2
	Asian	8.8	47.1	44.1
	Filipino	17.4	51.2	31.4
	Indochinese	20.0	45.5	34.5

Question 4:	Girls are better in science than boys.			
		Yes	Not Sure	No
	ALL	22.1	34.3	43.2
	Grade 2	33.8	25.8	39.4
	Grade 4	20.1	34.6	45.3
	Grade 6	11.1	43.2	45.7
	Male	6.0	37.0	56.6
	Female	38.2	31.8	29.7
	Hispanic	25.0	39.1	35.9
	White	18.1	30.5	51.2
	African Am.	28.9	30.5	38.3
	Asian	8.8	47.1	44.1
	Filipino	31.4	39.5	29.1
	Indochinese	25.5	38.2	36.4
Question 5:	I like to do science worksheets at school.			
		Yes	Not Sure	No
	ALL	49.4	22.6	27.5
	Grade 2	65.4	21.5	11.7
	Grade 4	46.9	25.8	27.3
	Grade 6	33.8	20.6	45.5
	Male	46.3	21.4	31.7
	Female	52.2	24.3	23.1
	Hispanic	51.3	22.3	25.9
	White	43.9	23.4	32.5
	African Am.	52.3	18.8	27.3
	Asian	44.1	26.5	29.4
	Filipino	69.8	15.1	15.1
	Indochinese	56.4	23.6	18.2

Question 6:	I like to do science experiments at school.			
		Yes	Not Sure	No
	ALL	85.7	9.3	4.6
	Grade 2	88.8	7.2	2.9
	Grade 4	87.6	8.9	3.6
	Grade 6	80.0	12.3	7.7
	Male	85.2	8.3	6.2
	Female	86.3	10.2	2.9
	Hispanic	86.0	9.3	3.6
	White	85.1	9.5	5.2
	African Am.	83.6	10.2	5.5
	Asian	85.3	11.8	2.9
	Filipino	93.0	2.3	4.7
	Indochinese	80.0	12.7	7.3
Question 7:	Our science textbook is interesting.			
		Yes	Not Sure	No
	ALL	52.8	26.6	20.2
	Grade 2	66.6	23.4	9.0
	Grade 4	58.0	26.6	15.4
	Grade 6	31.4	30.5	38.2
	Male	51.0	25.6	23.1
	Female	54.7	27.9	17.2
	Hispanic	50.5	32.3	16.7
	White	47.1	27.6	25.1
	African Am.	59.4	21.1	18.8
	Asian	44.1	38.2	17.6
	Filipino	64.0	22.1	14.0
	Indochinese	63.6	21.8	14.5

Question 8:	I read books about science for fun.			
		Yes	Not Sure	No
	ALL	41.7	17.9	39.9
	Grade 2	58.8	19.7	20.2
	Grade 4	40.4	17.7	41.9
	Grade 6	22.8	16.3	60.9
	Male	41.1	17.6	40.9
	Female	42.5	18.5	38.4
	Hispanic	37.5	20.3	40.1
	White	39.9	16.2	43.8
	African Am.	37.5	17.2	45.3
	Asian	41.2	29.4	29.4
	Filipino	66.3	18.6	15.1
	Indochinese	34.5	18.2	47.3
Question 9:	I think science is easy.			
		Yes	Not Sure	No
	ALL	48.6	32.5	18.5
	Grade 2	57.2	26.6	15.4
	Grade 4	43.4	36.9	19.8
	Grade 6	44.8	34.6	20.7
	Male	47.2	29.1	23.3
	Female	50.6	36.1	13.1
	Hispanic	46.4	32.8	19.3
	White	48.1	33.4	18.5
	African Am.	59.8	22.0	18.1
	Asian	38.2	52.9	8.8
	Filipino	44.2	38.4	17.4
	Indochinese	50.9	23.6	25.5

Question 10:	I use a computer at school.			
		Yes	Not Sure	No
	ALL	**73.0**	**7.3**	**19.3**
	Grade 2	75.0	7.4	16.8
	Grade 4	64.6	11.5	23.9
	Grade 6	79.4	2.8	17.8
	Male	75.0	7.8	16.7
	Female	71.0	6.9	22.0
	Hispanic	67.2	9.4	22.4
	White	76.1	6.7	17.0
	African Am.	71.1	6.3	22.7
	Asian	55.9	8.8	35.3
	Filipino	80.2	8.1	11.6
	Indochinese	72.7	10.9	16.4
Question 11:	Science class is interesting.			
		Yes	Not Sure	No
	ALL	**63.9**	**21.4**	**14.2**
	Grade 2	69.7	21.3	8.0
	Grade 4	72.9	18.9	8.3
	Grade 6	48.0	24.3	27.7
	Male	64.5	20.2	14.5
	Female	63.1	22.8	14.1
	Hispanic	65.1	19.3	15.1
	White	60.8	22.6	16.6
	African Am.	67.2	18.0	13.3
	Asian	55.9	29.4	14.7
	Filipino	72.1	18.6	8.1
	Indochinese	54.5	29.1	16.4

Question 12:	I need to do well in science to get a good job when I grow up.			
		Yes	Not Sure	No
	ALL	64.9	24.8	10.0
	Grade 2	85.6	8.5	5.1
	Grade 4	65.0	26.4	8.6
	Grade 6	41.2	41.5	17.3
	Male	68.5	21.6	9.5
	Female	61.2	28.1	10.5
	Hispanic	67.2	24.5	7.8
	White	60.0	28.6	11.5
	African Am.	72.7	17.2	10.2
	Asian	55.9	35.3	8.8
	Filipino	70.9	17.4	10.5
	Indochinese	70.4	18.5	11.1
Question 13:	I like to tell my family about what I learn in science.			
	ALL	63.1	17.0	19.6
	Grade 2	72.9	14.4	12.5
	Grade 4	65.8	17.0	17.0
	Grade 6	49.1	20.4	30.6
	Male	58.8	19.1	21.8
	Female	67.4	15.1	17.4
	Hispanic	68.2	16.7	14.6
	White	60.5	16.2	23.3
	African Am.	70.9	11.8	17.3
	Asian	52.9	26.5	20.6
	Filipino	61.6	23.3	15.1
	Indochinese	59.3	22.2	16.7

Question 14:	My family thinks it's important for me to			
	learn science.			
	ALL	**63.5**	**30.3**	**6.0**
	Grade 2	74.2	21.8	3.5
	Grade 4	65.9	29.9	4.2
	Grade 6	48.1	41.0	10.9
	Male	62.7	29.7	7.4
	Female	63.8	31.3	4.7
	Hispanic	68.1	26.7	4.7
	White	58.9	35.3	5.6
	African Am.	67.5	23.8	8.7
	Asian	57.6	33.3	9.1
	Filipino	69.8	24.4	5.8
	Indochinese	61.1	25.9	13.0

K-6 SCIENCE EVALUATION SURVEY
Parent Survey

These statements ask for your opinions about the science program at your child's school. Please indicate how much you agree or disagree with the statements listed below by darkening the circle on the green and white answer sheet. Be sure that the number on your answer sheet matches the number of the statement on the survey. Please use only a number 2 pencil. Do not use a pen. Do not put your name on this survey nor on the green and white answer sheet.

Please find the identification box in the upper left-hand corner of the green and white answer sheet. In the first block in the area labeled "IDENTIFICATION," enter the number from below which best describes your racial/ethnic background. Darken the circle below that matches the number you entered.

0 = Hispanic
1 = White
2 = African American
3 = Asian
4 = American Indian/ Alaskan Native
5 = Pacific Islander
6 = Portugese
7 = Filipino
8 = Indochinese

Please use the following rating scale when responding to the statements below.

1	2	3	4	5
Strongly Disagree	**Disagree**	**No Opinion**	**Agree**	**Strongly Agree**

1. Science encourages children to **think** rather than to merely memorize facts.
2. My child uses knowledge from his or her science class in everyday living.
3. The school's science program nurtures my child's natural curiosity.
4. The science program instills in my child the joy of learning about science.
5. My child enjoys science instruction.
6. My child is challenged by the science program in his/her classroom.
7. My child's classroom shows evidence of ongoing science activities (plants, animals, displays, experiments, etc.).
8. I think the school has adequate facilities to do hands-on science activities.
9. High expectations for success in science are held for my child.
10. My child participates in school-sponsored science activities outside the classroom.

Please use the following rating scale when responding to the statements below.

1	2	3	4	5
Strongly Disagree	**Disagree**	**No Opinion**	**Agree**	**Strongly Agree**

11. The school has a good collection of current elementary science books that are appropriate for my child's reading level.
12. My child shares his or her experiences about science with us at home.
13. My child enjoys completing science assignments.
14. My child's class size is appropriate for good learning in science.
15. I feel science is an important part of my child's education.
16. It seems to me that more time should be devoted to teaching science in school.
17. My child's progress in science is regularly reported to me.
18. The school program meets my expectations of a good science curriculum.
19. I think my child is doing well in science.
20. My child's teacher believes that my child can do well in science.
21. Science instruction is more important for boys than for girls.
22. I think that a strong background in science will help my child get a good job.
23. My child uses a computer at school.

Please respond to the following questions by darkening the circle on the green and white answer sheet which has the same number as your answer.

24. I am a:

1 = male
2 = female

25. My child (who brought home this survey) is in:

1 = grade 2
2 = grade 4
3 = grade 6

If you have any comments to make about the science program at your school, please use the white space on the answer sheet to respond. Thank you for taking your time to assist us with this survey. Please place the survey and the green and white answer sheet in the attached envelope and return it to your child's teacher **tomorrow**.

K-6 SCIENCE EVALUATION

Parent Survey Results

All	N=644	%
Males	N=184	29.8%
Females	N=425	68.9%
Grade 2	N=194	31.8%
Grade 4	N=225	36.8%
Grade 6	N=181	29.6%
Hispanic	N=96	17.3%
White	N=277	50.0%
African Am.	N=43	7.8%
Asian	N=38	6.9%
Am. Indian	N=6	1.1%
Pac. Islander	N=3	0.5%
Portugese	N=8	1.4%
Filipino	N=52	9.4%
Indochinese	N=20	3.6%

Question 1: Science encourages children to think rather than to merely memorize facts.

	Disagree	No Opinion	Agree
All	5.8	6.4	87.8
Grade 2	4.7	2.6	92.7
Grade 4	3.5	5.8	90.6
Grade 6	7.8	10.5	81.8
Hispanic	6.3	6.3	87.4
White	5.1	4.0	91.0
African Am.	4.7	7.0	88.4
Asian	0.0	18.9	81.1
Filipino	3.8	3.8	92.4

Question 2:	My child uses knowledge from his or her science class in everyday living.		
	Disagree	No Opinion	Agree
All	**14.9**	**19.9**	**65.1**
Grade 2	14.6	17.3	68.0
Grade 4	15.8	20.3	64.0
Grade 6	13.3	20.0	66.6
Hispanic	10.7	28.0	61.3
White	16.2	15.5	68.3
African Am.	20.9	25.6	53.5
Asian	21.0	23.7	55.2
Filipino	5.8	13.5	80.7
Question 3:	The school's science program nurtures my child's natural curiousity.		
	Disagree	No Opinion	Agree
All	**12.9**	**19.6**	**67.6**
Grade 2	14.6	17.3	68.0
Grade 4	13.0	19.6	67.4
Grade 6	10.0	21.1	68.8
Hispanic	7.5	20.2	72.3
White	17.0	19.2	63.8
African Am.	21.0	14.0	65.1
Asian	10.8	32.4	56.7
Filipino	1.9	13.5	84.6

Question 4:	The science program instills in my child the joy of learning about science.			
		No Opinion		
	Disagree		Agree	
All	14.1	18.2	67.6	
Grade 2	12.0	19.8	68.3	
Grade 4	15.4	16.3	68.3	
Grade 6	12.9	21.2	65.9	
Hispanic	6.4	17.9	75.8	
White	17.8	20.7	61.6	
African Am.	20.9	11.6	67.5	
Asian	18.9	27.0	54.0	
Filipino	1.9	15.4	82.7	
Question 5:	My child enjoys science instruction.			
		No Opinion		
	Disagree		Agree	
All	9.6	15.5	74.9	
Grade 2	6.8	17.2	76.0	
Grade 4	6.8	11.3	82.0	
Grade 6	14.5	17.8	67.8	
Hispanic	6.4	13.8	79.8	
White	10.1	13.4	76.5	
African Am.	9.3	16.3	74.4	
Asian	10.8	29.7	59.4	
Filipino	0.0	7.7	92.3	

Question 6:	My child is challenged by the science program in his/her classroom.			
	Disagree	No Opinion	Agree	
All	**22.4**	**28.9**	**48.8**	
Grade 2	17.7	31.3	51.0	
Grade 4	23.5	28.8	47.8	
Grade 6	22.9	27.4	49.7	
Hispanic	14.0	33.3	52.7	
White	27.5	28.5	44.1	
African Am.	21.4	28.6	50.0	
Asian	24.3	32.4	43.2	
Filipino	3.8	30.8	65.3	
Question 7:	My child's classroom shows evidence of ongoing science activities.			
	Disagree	No Opinion	Agree	
All	**22.3**	**26.8**	**50.9**	
Grade 2	20.2	25.9	53.9	
Grade 4	25.1	26.0	48.8	
Grade 6	21.8	28.5	49.7	
Hispanic	17.0	29.8	53.2	
White	27.6	26.4	56.1	
African Am.	27.9	30.2	41.9	
Asian	13.5	32.4	54.0	
Filipino	3.8	28.8	67.4	

Question 8:	I think the school has adequate facilities to do hands-on science activities.		
		No	
	Disagree	Opinion	Agree
All	32.7	32.8	33.5
Grade 2	29.7	33.3	37.0
Grade 4	42.8	24.8	32.4
Grade 6	25.9	39.9	34.3
Hispanic	19.1	42.6	38.3
White	48.6	30.8	20.7
African Am.	30.3	18.6	51.2
Asian	13.5	35.1	51.3
Filipino	15.3	36.5	48.0

Question 9:	High expectations for success in science are held for my child.		
		No	
	Disagree	Opinion	Agree
All	17.1	32.4	50.5
Grade 2	15.6	34.9	49.5
Grade 4	15.7	35.9	48.4
Grade 6	19.1	27.0	54.0
Hispanic	11.9	33.3	54.9
White	20.3	30.4	49.3
African Am.	16.3	34.9	48.9
Asian	16.2	27.0	56.7
Filipino	3.8	42.3	63.9

Question 10:	My child participates in school-sponsored science activities outside the classroom.			
	Disagree	No Opinion	Agree	
All	47.7	26.6	25.7	
Grade 2	41.7	32.3	26.0	
Grade 4	51.6	22.0	26.5	
Grade 6	51.7	26.1	22.3	
Hispanic	38.3	31.9	29.8	
White	57.8	23.1	19.1	
African Am.	51.2	25.6	23.2	
Asian	35.1	40.5	24.3	
Filipino	32.7	36.5	30.7	
Question 11:	The school has a good collection of current elementary science books that are appropriate for my child's reading level.			
	Disagree	No Opinion	Agree	
All	14.9	40.2	44.9	
Grade 2	14.3	43.7	42.1	
Grade 4	17.1	42.6	40.3	
Grade 6	13.3	37.8	48.9	
Hispanic	10.8	35.5	53.8	
White	19.3	47.4	33.2	
African Am.	12.2	19.5	68.3	
Asian	18.9	27.0	54.0	
Filipino	5.9	41.2	53.0	

Question 12:	My child shares his or her experiences about science with us at home.			
	Disagree	No Opinion	Agree	
All	**19.9**	**9.8**	**70.4**	
Grade 2	19.2	9.8	70.9	
Grade 4	19.3	7.2	73.5	
Grade 6	22.3	11.7	66.1	
Hispanic	18.3	12.9	68.8	
White	20.3	8.0	71.6	
African Am.	26.2	2.4	71.4	
Asian	21.6	18.9	59.5	
Filipino	9.6	7.7	82.7	

Question 13:	My child enjoys completing science assignments.			
	Disagree	No Opinion	Agree	
All	**11.2**	**18.7**	**70.0**	
Grade 2	9.3	18.7	72.0	
Grade 4	10.4	17.2	72.4	
Grade 6	14.5	20.7	64.8	
Hispanic	9.7	21.5	68.8	
White	11.7	19.8	68.5	
African Am.	14.3	9.5	76.1	
Asian	16.2	27.0	56.7	
Filipino	3.8	15.4	77.8	

Question 14:	**My child's class size is appropriate for good learning in science.**		
	Disagree	**No Opinion**	**Agree**
All	**37.2**	**23.7**	**39.1**
Grade 2	42.2	21.4	36.5
Grade 4	42.6	22.9	34.5
Grade 6	27.9	26.8	45.2
Hispanic	25.8	24.7	49.5
White	53.1	22.2	24.7
African Am.	23.8	14.3	61.9
Asian	24.3	24.3	51.3
Filipino	13.4	30.8	55.8

Question 15:	**I feel science is an important part of my child's education.**		
	Disagree	**No Opinion**	**Agree**
All	**5.1**	**4.6**	**90.4**
Grade 2	6.8	4.7	88.6
Grade 4	4.0	1.8	94.2
Grade 6	3.9	6.1	90.0
Hispanic	6.5	7.5	86.0
White	4.0	2.2	93.8
African Am.	2.4	9.5	88.1
Asian	5.4	8.1	86.4
Filipino	1.9	3.8	94.3

Question 16: **It seems to me that more time should be devoted to teaching science.**

	Disagree	No Opinion	Agree
All	**10.9**	**22.6**	**66.5**
Grade 2	10.9	24.0	65.1
Grade 4	10.7	22.0	67.3
Grade 6	9.5	21.1	69.4
Hispanic	16.2	25.8	58.0
White	10.6	18.9	70.6
African Am.	11.9	16.7	71.4
Asian	5.4	29.7	64.8
Filipino	3.8	28.8	67.3

Question 17: **My child's progress in science is regularly reported to me.**

	Disagree	No Opinion	Agree
All	**38.0**	**21.4**	**40.1**
Grade 2	41.2	21.9	37.0
Grade 4	38.5	24.7	36.7
Grade 6	34.7	15.6	49.9
Hispanic	36.9	26.1	37.0
White	43.2	20.7	36.0
African Am.	47.7	11.9	40.5
Asian	47.8	21.6	40.5
Filipino	17.3	26.9	55.8

Question 18:	The school program meets my expectations of a good science curriculum.			
	Disagree	No Opinion	Agree	
All	29.2	39.9	31.0	
Grade 2	26.0	41.1	32.8	
Grade 4	36.5	38.3	25.2	
Grade 6	24.4	42.2	33.3	
Hispanic	17.3	45.2	37.6	
White	44.0	36.4	19.6	
African Am.	19.1	33.3	47.6	
Asian	10.8	45.9	43.2	
Filipino	11.5	53.8	34.6	
Question 19:	I think my child is doing well in science.			
	Disagree	No Opinion	Agree	
All	10.6	21.4	68.0	
Grade 2	8.9	27.5	63.8	
Grade 4	11.3	18.5	70.3	
Grade 6	10.6	19.0	70.4	
Hispanic	9.7	25.8	64.5	
White	10.6	21.9	67.5	
African Am.	9.5	19.0	71.5	
Asian	8.1	16.2	76.7	
Filipino	0.0	19.2	80.8	

Question 20:	My child's teacher believes that my child can do well in science.		
	Disagree	No Opinion	Agree
All	**5.5**	**39.7**	**54.8**
Grade 2	3.1	44.5	52.4
Grade 4	6.8	38.7	54.5
Grade 6	5.0	35.6	59.4
Hispanic	6.5	40.9	52.7
White	5.2	39.8	55.1
African Am.	9.6	26.2	64.3
Asian	5.4	37.8	56.7
Filipino	0.0	34.6	65.4

Question 21:	Science instruction is more important for boys than for girls.		
	Disagree	No Opinion	Agree
All	**79.8**	**12.6**	**7.6**
Grade 2	82.3	11.5	6.2
Grade 4	84.8	9.9	5.3
Grade 6	73.9	14.4	11.7
Hispanic	78.5	16.1	5.4
White	89.1	5.8	5.0
African Am.	76.2	11.9	11.9
Asian	54.0	32.4	13.5
Filipino	71.2	21.2	7.7

Question 22:	I think that a strong background in science will help my child get a good job.		
	Disagree	No Opinion	Agree
All	**13.2**	**22.0**	**64.7**
Grade 2	15.1	21.8	63.2
Grade 4	11.7	22.9	65.5
Grade 6	12.3	20.7	67.1
Hispanic	9.7	26.9	63.4
White	10.3	21.2	68.6
African Am.	16.7	26.2	57.1
Asian	16.2	18.9	64.8
Filipino	11.6	23.1	65.4

Question 23:	My child uses a computer at school.		
	Disagree	No Opinion	Agree
All	**18.8**	**12.3**	**68.9**
Grade 2	20.3	12.4	67.4
Grade 4	17.7	12.7	69.7
Grade 6	16.8	10.1	73.2
Hispanic	22.9	15.2	62.0
White	17.0	8.1	75.0
African Am.	34.1	9.8	56.1
Asian	27.0	13.5	59.4
Filipino	13.5	11.5	75.0

APPENDIX C

PRINCIPAL INTERVIEWS, CLASSROOM OBSERVATIONS, AND TEACHER SCHEDULE REVIEW METHODOLOGY AND INSTRUMENTS

EVALUATION OF THE K-6 SCIENCE PROGRAM
Principal Interviews, Classroom Observations, and Teacher Schedule Review

During the course of the K-6 Science Evaluation, an effort was made to follow the suggestions and advice of the project advisory committee and the district Science Office. The evaluation design called for the use of principal interviews, classroom observations, and teacher schedule reviews to gather information regarding science instruction at the school site level.

METHODOLOGY

Thirty-one elementary and middle schools participated in the PQR process during the 1988-1989 school year. As a part of the PQR process, these schools compared their science programs to the California State Quality Criteria and produced a written report which was available for review. Since these schools had recently studied their site science programs, they were selected to participate in the principal interview, classroom observation, and teacher schedule review portion of the K-6 Science Evaluation.

Principal Interviews and Classroom Observations

From the list of 31 schools mentioned above, 16 were selected to participate in principal interviews and classroom observations. The 16 schools included in this portion of the study represented four schools from each of the district's four operations areas.

Consultant Merrilee Finley scheduled interview appointments with the principals of the 16 schools and sent them a copy of the questions prior to the interview session. Principal interview questions were developed to answer questions posed by the evaluation design and are included in this section of the appendix. Interview sessions lasted approximately one hour. Principals' responses were summarized by Ms. Finley and presented to the Evaluation Department for inclusion in the final report.

At the time of the principal interview, Ms. Finley obtained the weekly classroom schedules of all teachers at each site. After determining when science instruction was scheduled in each classroom, Ms. Finley selected one classroom per grade level for observation of science instruction. Teachers were notified of scheduled classroom observations in advance. The observation checklist was developed to answer questions regarding facilities, classroom environment, classroom composition, affective elements, and instructional strategies, materials, and activities. Results of the classroom observations were compiled and summarized by Ms. Finley and presented to the Evaluation for inclusion in the final report.

Teacher Weekly Schedule Review

Weekly teacher schedules were requested from the 31 schools that participated in the PQR process during the 1988-1989 school year. Schedules were received from 26 elementary schools and 2 middle schools with sixth grades. These schedules represented 539 classrooms. Information gathered answered questions from the evaluation design relating to the number of minutes of science instruction scheduled per week, methods of scheduling science instruction (for example, science taught as a single subject, block scheduling, science integrated with other subject areas), and the time of day science instruction was scheduled. In addition, information was gathered on grade level (kindergarten, primary, and upper), school level (elementary vs. middle school), AGP vs. non-AGP schools, Math/Science magnet schools vs. non-Math/Science magnet schools, type of class, and teacher gender. Data gathered were entered into a data base on dBase III+ and analyzed using the Statistical Package for the Social Sciences (SPSS). The results of the teacher weekly schedule review are included in the Findings section of the Evaluation of the K-6 Science Program report.

SAN DIEGO CITY SCHOOLS
Planning, Research, and Evaluation Division
Evaluation Department

K-6 SCIENCE EVALUATION
Principal Interview

The purpose of this interview is to obtain information regarding the science program at your site. Your responses to the following items will provide important information about science instruction for the K-6 Science Evaluation. Elementary principals, please base your responses to these questions on the science programs of classroom teachers at your site. Middle school principals, please think of the people responsible for sixth grade science instruction at your site.

1. In your classroom observations, have you found that teachers seem comfortable when teaching the district's K-6 science program?

2. In your classroom observations, have you found that teachers seem well-prepared to teach the district's K-6 science program?

3. Has the staff at your site defined any schoolwide goals that focus on science (ie. PQIR Improvement, GATE Plan, Inservice objectives)?

4. Have any staff members at your site defined any personal goals that focus on science (ie. Stull Bill objectives, professional growth objectives)?

5. Have any teachers at your site implemented innovative activities or teaching strategies within their science programs?

6. Does your site sponsor any schoolwide science activities in which students can participate?

7. How important do parents consider science as compared to other subject areas?

8. What do parents report to you as their priorities for science instruction?

9. Do teachers express any unmet needs in the areas of science instruction or inservice training? If yes, what needs have been expressed?

10. Do most teachers at your site follow the district science curriculum?

    Do the teachers following the district science curriculum find that it is adequate to teach K-6 science?

11. Do most teachers at your site use the science curriculum materials provided by the district (student texts, science kits, filmstrips, teachers' guide)?

    If not, what curriculum materials do they use instead of or in addition to the district science materials?

12. Are on-site science inservices available for teachers? If so, do teachers find them to be helpful?

13. Do teachers use technology (computers, video) as a part of science instruction? If yes, describe how technology is used.

14. Can you describe any efforts the school has made to include or highlight contributions of various racial/ethnic groups in science?

15. Please list any strengths and/or weaknesses in the science program at your site.

For middle schools:

16. How is science scheduled for sixth grade students at your site?

For restructuring schools:

17. Has your science program changed as a result of your restructuring efforts? If yes, please describe.

For science magnet schools:

18. How is your science program different from science programs at other schools?

SCIENCE EVALUATION OBSERVATION

Teacher's Name ______________________

School Name ______________________ **Date** ______________ **Science not being taught** ____

Grade Level __________ **Time of Observation** __________ **to** __________

	COMMENTS
Facilities ___ Classroom arrangement is suitable for group work ___ Tables ___ Sink	
Classroom Environment Evidence that science is taught/valued: ___ Student science work displayed ___ Animals, exhibits ___ Supplementary books available ___ Supplementary science materials available ___ Evidence of computer use ___ Daily schedules include science ___ Science centers ___ Science posters, bulletin boards	
Classroom Composition ___ Regular ___ GATE ___ LEP ___ Sheltered English ___ Special Education ___ Bilingual ___ Lab Situation	
Affective Elements ___ Positive teacher attitude/enthusiasm ___ Positive student attitude/enthusiasm	

SCIENCE EVALUATION OBSERVATION CHECKLIST

PAGE 2

This science lesson was:
___ on teacher's daily schedule
___ scheduled by appointment
___ observed by chance.

Science Lesson Observation

Minutes **Instructional strategies** (Check all that apply. Circle activities when students most engaged.)

___ ___ Lecture
___ ___ Teacher Demonstration
___ ___ Students reading aloud
___ ___ Teacher reading to students
___ ___ Peer teaching
___ ___ Teacher summarizing material
___ ___ Cooperative learning
___ ___ Switch teaching
___ ___ Hands-on activities
___ ___ Integrated curriculum
___ ___ Open-ended questions/discussion
___ ___ Feedback specific to activity
___ ___ Technology used (computers, video)
___ ___ Parent volunteer
___ ___ Instructional Aide

COMMENTS

Materials and activities

District science materials used
___ Text books
___ Teachers' Edition
___ District science kit
___ District worksheets

Other materials used
___ Teacher-made materials
___ Commercial materials

___ All students appear actively engaged
___ Students write/communicate about science
___ Assignments (___Traditional ___ Open Ended)
___ Children/teacher ponder and question together
___ Teacher models scientific process
___ Team teaching
___ Lesson related to real-world experiences

APPENDIX D

ELEMENTARY SCIENCE PROGRAM EVALUATION TEST (ESPET) FACT SHEETS, METHODOLOGY, AND RESULTS

EVALUATION OF THE K-6 SCIENCE PROGRAM
Elementary Science Program Evaluation Test (ESPET)

During the course of the K-6 Science Evaluation, an effort was made to follow the suggestions and advice of the project advisory committee and the district Science Office. The evaluation design called for the administration of a performance-based test to gather information on the strengths and weaknesses of the district science program with respect to the development of process skills. This portion of the assessment was not intended to measure individual student achievement, but to assess science program accomplishments. The New York Elementary Science Program Evaluation Test (ESPET) was used for this purpose, because the test had been used successfully in the field and had been normed. Although ESPET was given to students in fourth grade, it is intended to be a cumulative measure of the process skills students would be expected to master in kindergarten through grade 4. A description of ESPET, a fact sheet on ESPET testing in the district, and ESPET mean scores by district, ethnicity, and gender are included in this appendix.

TEST METHODOLOGY

Training

The New York State Education Department agreed to allow the Evaluation Department to use ESPET only if test administrators were trained by New York personnel. The Evaluation Department sponsored this training with the San Diego County Office of Education in February 1990. Participants were selected in the following ways:

- Classroom teachers who were known to the Science Office as interested in science education were invited to attend ESPET training. The Science Office provided funding for these teachers to attend the training.
- Teachers at restructuring schools were invited to participate in ESPET training. Funding for these teachers was provided by the Innovative and Change Leadership Group (ICLG).
- Mentor teachers who were known to the Science Office as interested in science education were invited to attend ESPET training. The Mentor Office provided funding for these teachers to attend the training.
- Gifted and Talented Education (GATE) central office resource teachers, funded by the GATE Department, attended the training.
- Project 2061 provided funding for some project members to attend ESPET training.
- The Evaluation Department and the Magnet Office also provided funding for some ESPET participants.

Approximately 70 people attended one of two training sessions held on either February 13-14, 1990 or February 15-16, 1990. The ESPET training attracted a number of participants from outside San Diego City Schools. Representatives from other California school districts, the California State Department of Education, and the University of California at San Diego attended ESPET training sessions.

All district participants in the training sessions were asked to administer ESPET at their elementary school sites. Schools were selected to participate in ESPET testing if a representative from the school site attended training. Participants who were not assigned to a school site were asked to assist at one or two school sites selected for testing.

Test Administration

ESPET testing took place in February and March 1990 at 23 district elementary schools. A total of 1738 fourth grade students completed the test. The test was administered in both English and Spanish. A variety of programs such as Math/Science Magnets, Achievement Goals Program (AGP), restructuring schools, Voluntary Ethnic Enrollment Program (VEEP), and schools with regular district programs were represented in participating schools. In order to provide information about ESPET and to minimize teacher anxiety, memos were sent to all fourth grade teachers whose classrooms would be participating in the testing.

Four testing kits were purchased from the New York Education Department and assembled by Evaluation Department staff. Each kit contained enough materials and supplies to test 30-35 students per testing session. Test administrators were responsible for delivering the testing kit to the next school site on the schedule. The Evaluation Department was responsible for scheduling testing dates and refurbishing kits as needed.

Test Scoring

In order to ensure scoring consistency, the K-6 Science Evaluation Advisory Committee decided that the scoring of ESPET would be done centrally, with student answer sheets and analyses of program strengths and weaknesses returned to school sites for their own use. All ESPET-trained test administrators were invited to participate in the scoring session which took place at the district office on Saturday, March 24, 1990. Approximately 15 people attended.

The New York State ESPET "Directions for Administering and Scoring" was used as a guideline for scoring. Participants in the scoring session were assigned to teams, and each team was responsible for scoring one section of the test. This method ensured consistency and streamlined the scoring process.

Following hand-scoring of the 1738 ESPET student answer sheets, a data base was created by the Evaluation Department using dBase III+. In addition to student responses, information gathered included student gender, student ethnicity, teacher name, and school location. Data were analyzed by the Evaluation Department using the Statistical Package for the Social Sciences (SPSS) to determine response frequencies for each item. Analyses of variance (ANOVAs) were preformed to identify significant differences in student scores by ethnicity, gender, program type (GATE vs. non-Gate), and school type (restructuring, Math/Science Magnet, Achievement Goals Program).

Following the analysis of the ESPET data, student answer sheets were returned to each school site for their information. In addition, each school site received a summary of their ESPET mean scores as well as mean scores for the district as a whole. Student answer sheets were later returned to the Evaluation Department for reference.

Science

STUDENTS GET HANDS ON SCIENCE IN PERFORMANCE-BASED TEST

At first glance the classroom looks more like a kindergarten than the setting for a grade 4 science test. The balances catch the attention at once—five of them, apparently randomly distributed across the five rows and five columns of the desks. The balances are about eighteen inches high, obviously homemade. The shaft is a dowel, the beam is fixed to a large nail across a notch, and the baskets, which are two plastic salad bowls from any grocery store, are suspended by paper clips bent over the ends of the beam. Lumps of modeling clay ensure the balance. On the same desk at the foot of the balance shaft are a green plastic cup containing water, a clear plastic glass with a line around it half way up, a plastic measuring jug, a ruler, a thermometer, and 10 shiny new pennies.

Walking up and down the rows, you see on some desks an electrical battery connected to a tiny light bulb, with two wires from the bulb terminating in alligator clips. A plastic bag containing what looks like a spoon and a paper clip among other oddments lies next to it. On other desks, a single box. Another holds three pieces of paper marked A, B, and C, a paper encased in a plastic bag, a dropper, and a small plastic container of water. The last variation is a simple paper plate divided into three for a TV dinner, with labelled instructions, and a plastic bag containing a collection of beans, peas, and corn.

This is the manipulative skills portion of the New York State Elementary Science Program Evaluation Test—ESPET. It is only one part of a seven-part program: five parts are optional questionnaires on the elementary science program in New York State schools; the multiple-choice and the manipulative skills test are mandatory.

Every student has seven minutes to work on each of five scientific tasks, which are arranged on the tables. At the end of the time, the teacher at the front of the room organizes a swift exchange of desks (called "stations"). The front row children all go to the back of the column, carrying their answer sheets with them, and all the others move up one desk. Thus every child has a turn at all five stations, which have been arranged so that adjacent stations do not have the same apparatus. Four classes of about 25 children each can be tested comfortably in a school day. The building mentor teacher is responsible for setting up and running the test, while classroom teachers bring in their classes at intervals of about one hour.

All 4th graders take this test, including special education and limited English speaking students. The objective is to improve science education by testing what should be taught.

From Ruth Mitchell, "A Sample of Authentic Assessment"
Prepared for California State Department of Education
Beyond the Bubble conference, Fall 1989

SAN DIEGO CITY SCHOOLS

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PLANNING, RESEARCH, AND EVALUATION DIVISION
Evaluation Department

NEW YORK STATE ELEMENTARY SCIENCE PROGRAM EVALUATION TEST (ESPET) FACT SHEET

Twenty-three elementary schools participated in the testing.

Math/Science Magnets
- Encanto (2 classes)
- Grant
- Johnson

AGP
- Dailard
- Emerson
- Grant
- Horton
- Johnson
- Linda Vista
- Lowell

Restructuring Schools
- Bay Park
- Emerson
- Fremont
- Hamilton
- Jefferson
- Jerabek
- La Jolla
- Linda Vista
- Sunset View
- Toler

Other Schools
- Brooklyn
- Carson
- Encanto (2 classes)
- Franklin
- Hawthorne
- Hickman
- Lee
- Marvin

A total of 1738 fourth-grade students took ESPET. This group represents 18.4 percent of all district fourth graders. There were 869 males (50.1 percent) and 864 females (49.9 percent).

The ethnicity of the sample closely mirrors the ethnicity of the district's K-6 population.

Racial/Ethnic Group	Sample	K-6 Population
African American	15.0% (253)	16.7%
Asian	3.4% (58)	2.1%
Filipino	5.6% (94)	7.7%
Hispanic	27.3% (460)	27.4%
Indochinese	7.3% (123)	7.1%
White	41.4% (699)	37.8%

ESPET MEAN SCORES BY GENDER (PERCENT)

Station	Item No.	Skill Activity	Males N=869	Females N=864	**Total District**
1	2	Measuring Mass	53	42	**48**
1	3	Measuring Length	68	68	**68**
1	4	Measuring Volume	36	35	**35**
1	5	Measuring Temperature	66	73	**69**
2	1	Observing	75	81	**78**
2	2	Predicting	57	62	**60**
2	3	Interpreting Data	43	44	**44**
3	1	Classifying	51	53	**52**
3	2	Classifying	47	50	**49**
4	2	Manipulating Materials	85	77	**81**
4	3	Generalizing	37	36	**37**
5	1	Inferring	47	43	**45**
5	2	Inferring	87	89	**88**
5	3	Inferring	32	28	**30**
5	5	Interpreting Data	61	68	**64**

ESPET MEAN SCORES BY ETHNICITY (PERCENT)

Station	Item No.	Skill Activity	Hispanic	White	African American	Asian	Filipino	Indochinese	**Total District**
1	2	Measuring Mass	36	63	34	40	54	37	**48**
1	3	Measuring Length	57	79	58	66	71	67	**68**
1	4	Measuring Volume	27	46	25	38	36	25	**35**
1	5	Measuring Temperature	58	76	67	76	79	70	**69**
2	1	Observing	67	89	73	79	83	60	**78**
2	2	Predicting	48	71	57	60	65	43	**60**
2	3	Interpreting Data	30	59	32	48	52	24	**44**
3	1	Classifying	44	61	49	52	53	34	**52**
3	2	Classifying	40	60	42	53	52	30	**49**
4	2	Manipulating Materials	72	88	78	81	88	77	**81**
4	3	Generalizing	26	46	25	41	52	30	**37**
5	1	Inferring	30	62	36	50	53	23	**45**
5	2	Inferring	80	94	89	84	88	81	**88**
5	3	Inferring	22	37	26	34	36	22	**30**
5	5	Interpreting Data	51	77	53	71	72	59	**64**